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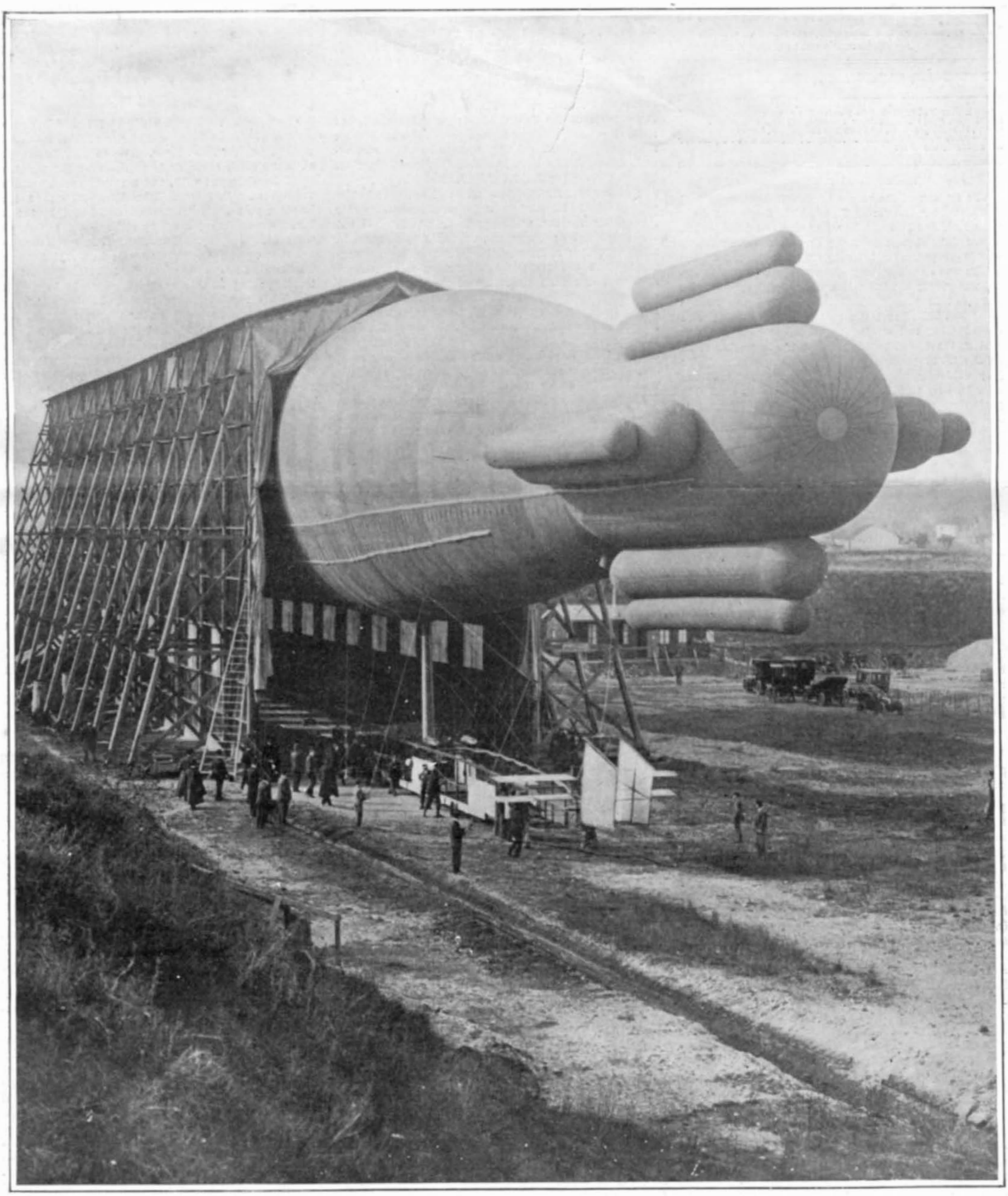
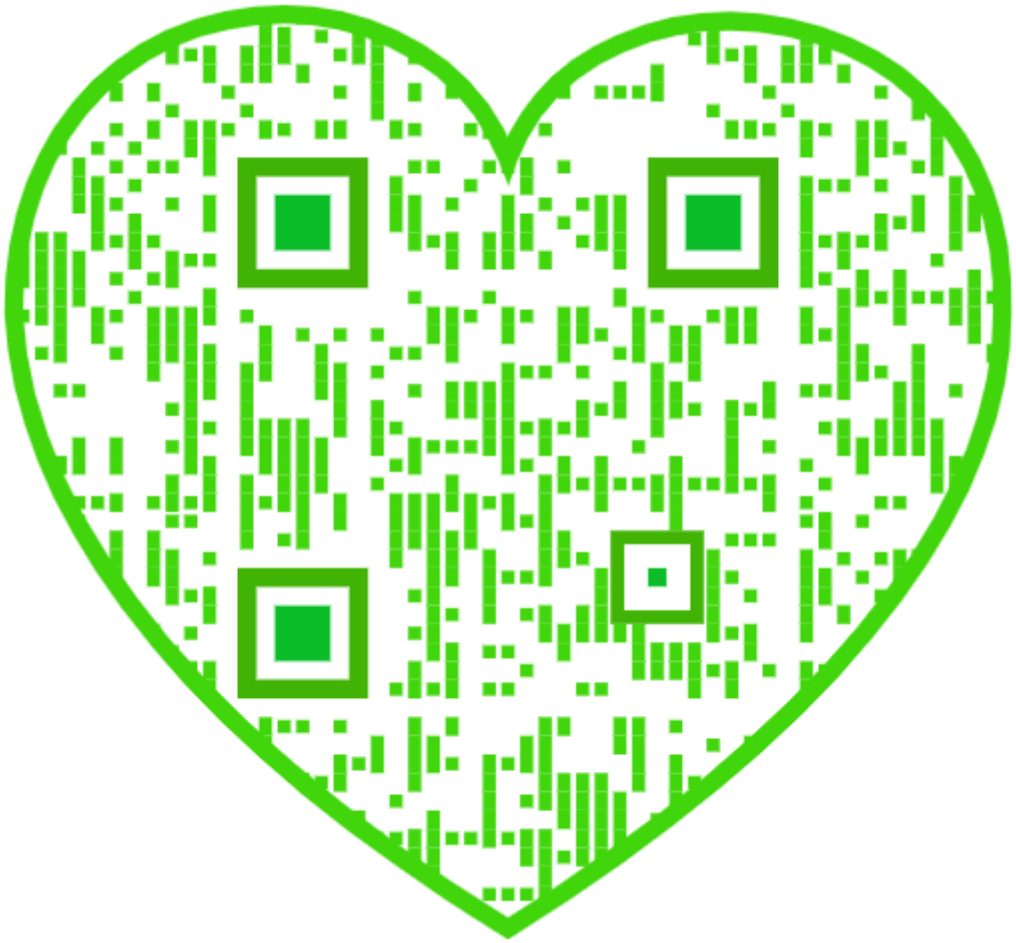


THE LATEST FRENCH AIRSHIP, THE "VILLE DE PARIS," BACKING OUT OF ITS SHED BEFORE MAKING AN ASCENT.—[See page 363.]

The balloon is 203.42 feet long and 34.45 feet in diameter. It has a capacity of 113,005 cubic feet and requires a 70-horse-power gasoline motor connected to a 19.68-foot propeller to drive it through the air.



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NEW YORK, SATURDAY, NOVEMBER 17, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

DRAWBRIDGE PROTECTION.

The finding of the coroner's jury in the accident at Atlantic City drawbridge, in which fifty-seven lives were lost, has laid the blame upon the bridge tender, whose duty it was to make certain that everything was in proper order before giving the signal that the bridge was clear for the passage of the train. The signal was given; but the evidence showed that the tracks were not in proper adjustment. A rail end on the draw had failed to settle into proper alinement with the abutting rail on the approach, and its end was still in the raised position facing the oncoming train as the latter passed on to the draw. The coroner's jury evidently accepted the testimony of one of the experts, who stated that he found evidence that this projecting rail was caught by the pilot, and that it had struck a glancing blow upon the leading truck, which had been sufficient to derail it. We notice, moreover, that although the bridge was provided with outside wooden guard rails, the customary steel guard rails on the inside of the tracks had not been laid down. This was a most fatal omission; for had they been in place, the derailed train would probably never have left the bridge.

This deplorable accident raises again the question as to how far safety of railroad travel is to be sacrificed to its speed. In the early days of railroading, it was an invariable rule that trains should come to a full stop on approaching a drawbridge, and not proceed until they had received the signal to go ahead from the bridge tender. This arrangement permits of plenty of time for a thorough examination of the drawbridge, and is a safeguard against hasty and careless inspection; but on the other hand, it involves an additional delay, which the operating department is reluctant to grant in these days, when the demand for high speed is becoming so universal and imperative.

THE BEHR MONO-RAIL IN BROOKLYN.

At a hearing held last week by the Committee on Plans of the Rapid Transit Commission, plans were presented for the construction of a Rapid Transit Railroad on Long Island, to be built upon the Behr mono-rail system. The members of the commission gave the proposal an extended hearing, and seemed to regard it with considerable favor. If the plans should be adopted, Greater New York will possess the first mono-rail system to be built and operated in this country. It was proposed to the Board that a franchise be granted for the building of an elevated line from the Atlantic Avenue ferry in Brooklyn to Coney Island. Mr. Behr stated to the commission that the road could be built within twelve months of the signing of the contract, and that the system would immediately relieve the Brooklyn Bridge to the extent of accommodating about 45,000 people during each rush hour.

As explained to the Rapid Transit Board, it was proposed to use a special design of car, capable of accommodating 170 seated and 80 standing passengers, and the offer was made to guarantee an average speed of 65 miles an hour including stops. Because of the peculiar construction of the track and cars, including the essential fact that the center of gravity of the cars would be below their point of support, it would be possible to make use of speeds of over 100 miles an hour between stops. The road is estimated to cost approximately $170,000 per mile, and the estimated cost of the cars, which are of exceptional size, is $45,000 each. The rail is six feet above the roadbed, and on account of the low center of gravity referred to the danger of derailment on curves is eliminated. A mono-rail system of this type is in operation in Germany, and it is believed that the conditions in Brooklyn would be particularly favorable to the successful operation of the road.

EXPORTS AND IMPORTS UNDER THE NEW GROUPING.

Under the new grouping adopted by the Department of Commerce and Labor for the statistics of trade of the United States, it is made apparent that articles in a natural state form a steadily increasing share of our imports, and a steadily decreasing share of our exports. Conversely, articles upon which labor has been expended in preparation for consumption form a steadily decreasing share of the imports and increasing share of the exports. This is proved by an analysis of our trade from 1870 to 1906. At the beginning of that period articles in the natural state formed only 26 per cent of the imports; but in 1906 such articles form 46 per cent of the total; while of the exports, articles in the natural state formed 68 per cent in 1870, but had fallen to 39.88 per cent of the whole in 1906.

At the beginning of the present fiscal year, the Bureau of Statistics adopted a new classification both of imports and exports. Thirty-six years ago, when the exports of the United States consisted chiefly of natural products, the old classification grouped them according to the source of production, rather than according to the condition in which they were exported. The new grouping divides the articles both of import and export into six leading classes: Foodstuffs in the natural state and food animals; crude materials for manufacturing; foodstuffs partly or wholly prepared for consumption; manufactures for further use in manufacturing; and manufactures ready for consumption; while the sixth group includes miscellaneous articles not falling naturally into any of the five classes. This new grouping has been applied to the imports and exports of each year as far back as, and including, the year 1870, and the analysis of the commerce of the United States during that period is of decided interest as showing the trend of manufacture, and the changing conditions as affecting our relations with other trading peoples.

A combination of the first three groups brings into one large class all articles imported or exported in the natural state as taken from the farm, forest, or the mine; while a combination of the last three groups brings similarly into one class the articles which have been advanced from their natural state through the application of labor. In the year 1870 about three-fourths of the imports were articles upon which labor had been expended before their importation, in putting them into condition for use in the United States. By 1880 the proportion had fallen to 64 per cent; in 1890 it was 61 per cent. A decade later it had fallen to 55 per cent, and in 1906 to 54 per cent. In the same intervals the proportion of the imports which came into the country in the natural state grew from 26 per cent in 1870 to 36 per cent in 1880; 45 per cent in 1900, and 46 per cent in 1906. Turning now to the export side, we find that the proportion of the domestic merchandise sent out of the country in the natural state decreased from 68 per cent in 1870 to 52 per cent in 1890, and to less than 40 per cent in 1906; while the proportion of articles manufactured, or upon which work was done, to the total exports from the country, rose from 32 per cent in 1870 to over 60 per cent in 1906.

CAPE TO CAIRO BY RAIL, RIVER, AND LAKE.

The connected and comprehensive description of the work that has been done and is immediately projected on the so-called Cape-to-Cairo Railway, which is given elsewhere in this issue, will satisfy any impartial reader that this stupendous and romantic dream of the late Cecil Rhodes is destined to see a very practical fulfillment.

That this new transcontinental route will not be "all-rail," but will include long stretches of transportation on lake and river, detracts nothing from its significance, nor, indeed, from its initial usefulness. For in the early stages of the operation of pioneer routes of this character, time is not the vital consideration which it becomes in the later days when trade has developed.

At the present writing the line has been built over 2,000 miles north from Cape Town and some 1,500 miles south from Cairo. With the completion of the 450-mile section which is now being built northward to the southern extremity of Lake Tanganyika, there will remain only 410 miles of railroad to be built in order to give a continuous rail, river, and lake route from Cape Town to the Mediterranean.

The length of the line yet to be constructed extends from the Broken Hill Mine for a distance of 450 miles to Kituta at the southern end of Lake Tanganyika, at which point the sway of the Chartered Company of South Africa, which is carrying out the work, terminates. Survey work upon this section is now in progress, and the line will reach the lake within the next year and a half. From this point onward, the original scheme propounded by Cecil Rhodes has had to be considerably modified. At the time the project was formulated, knowledge concerning the geographical configuration of the country around Lake Tanganyika was scanty; and subsequent exploration has shown that the rugged nature of the country renders railroad construction well-nigh impossible. On the one hand the lake is hemmed in by towering mountains, to tunnel or climb which would offer prodigious engineering difficulties, while the expense entailed could never be recouped. On the other hand, the lake itself affords a magnificent navigable waterway throughout its entire length of 400 miles, and furthermore it is on the direct line of the railroad to Cairo. Passengers will disembark from the train at Kituta on the southern shore, and be conveyed by steamboat to Usambara at the north end of the lake. Farther north in the same line lies Lake Kivu, separated by a narrow isthmus, only 90 miles across. This link offers no difficulties to railroad construction, beyond involving a steady climb of 2,000 feet. Lake Kivu is 60 miles in length and is similarly hemmed in by precipitous mountains, so that another break in the line will have to be made, and the facilities offered by the waterway adopted.

From Lake Kivu to the Albert Edward Lake is a further 60 miles with a further rise of 2,000 feet to the highest point on the route. The country to the east of this stretch of water is so flat that the waterway could be dispensed with, and a railroad easily and advantageously laid from Lake Kivu through a rich, healthy, and densely-populated country, past the Albert Edward Lake, and down the Semliki Valley to the southern shore of the Albert Lake—a distance of 220 miles. The Semliki Valley is in Congo territory. The road, it is true, could be laid through British territory; but in this event there would be a climb of 2,000 feet and a sudden descent of 3,000 feet; whereas by the former route there is no engineering difficulty before reaching the level of the Albert Lake. Once this sheet of water is gained, there is a continuous navigable channel to the Mediterranean by way of the White Nile, except for a stretch between Dufile and Rejaf, where the river for about 100 miles is broken by swift rapids. This distance would have to be spanned by another short length of railroad.

There is, however, an alternative route through Abyssinia, the emperor of which, under the Frontier Agreement of May, 1902, agreed to extend permission for the construction of the railroad through his dominions from the Soudan to Uganda. At that time the navigable route, *via* the Nile, was interrupted by the vast sudd, which obstructed the waterway between Fashoda and Lake Albert. This has, however, now been broken up, leaving a perfect fairway. Since the early part of 1904 a regular service of steamers has been plying between Rejaf and Khartoum, a distance of 1,000 miles, and Khartoum is now connected with Cairo by railroad except for a short distance from Wady Halfa and Aswan, where the river is again utilized.

It will thus be seen that when the railroad head reaches Kituta at the southern end of Lake Tanganyika (a distance of 450 miles, which has yet to be covered) there will be a further 410 miles only of railroad to be constructed between the chains of lakes, to give an efficient and combined railroad and waterway connection between Cape Town and Cairo. The exact line which the railroad will take of the various alternative routes at present available has not yet been determined, but the decision will be made during the next few months. In seeking to establish a railroad from the north to the south of the African continent in a continuous stretch for 6,000 miles, the idea of Mr. Rhodes was to avoid passengers changing from boat to train and *vice versa*, together with the avoidance of breaking bulk in freight, but this disadvantage could be overcome by the utilization of train ferries upon the various lakes. At the same time the transshipping of freight necessitated by the changes from land to water transport constitutes no serious drawback to the general utility of the scheme, at least for the present.

When this project was launched, its originator was not thinking so much of a railroad from north to south for through direct transport, but of the construction of a railroad backbone through the heart of the continent, which would offer an incentive to the development of the interior towns and centers of industry; moreover, he looked for the ramification of short-distance railroads both east and west of the main artery, and this expectation is already being rapidly fulfilled. Extending from the trans-African road are several extensions connecting the trunk line with the coast at various points: Notably those from Beira on the east coast to Buluwayo, and the Uganda Railroad from Mombasa to the Victoria Nyanza. There is also a line some 243 miles in length in course of construction between the southern end of Lake Nyassa and M'Tombi on the Shiré River, whence there is a steamer service to the seacoast *via* the Zambesi River.

Numerous other railroads projected through the

various foreign colonies lining the Cape to Cairo Railroad on either side are being proceeded with, which will act as feeders to the trans-African trunk railroad; and as the country around the various towns such as Mafeking and Buluwayo is rising in importance and increasing in prosperity, short-distance roads are being linked up with the main artery in all directions at such points.

PEARY'S "FARTHEST NORTH."

On July 16, 1905, Commander Peary's polar steamship, specially designed for Arctic exploration, left New York on her quest for the North Pole. She had a crew of twenty men, under Capt. Bartlett. Commander Peary did not go with the ship from New York, but joined her later at Sydney, Cape Breton, where she took on coal and additional supplies. The "Roosevelt" left Sydney on July 26. She was next reported at Domino Run, Labrador, July 29, from which point she crossed to Greenland. The vessel was next heard from at Etah, North Greenland. She passed Cape York August 7, and reached Etah on August 16. The expedition's auxiliary steamer, the "Erik," in the meantime had visited various settlements in Greenland and obtained natives and dogs for the explorer and turned them over to the "Roosevelt" on August 13. At Etah the "Roosevelt" overhauled her machinery, took on board her last supply of coal from the "Erik" and thence proceeded north with twenty-three Eskimos and about two hundred dogs.

What Commander Peary did and his experiences during the last year in the frozen North are rather curtly but tellingly summarized in a communication received by Herbert L. Bridgman, secretary of the Peary Arctic Club. The communication follows:

Hopedale, Labrador, *via* Twillingate, Newfoundland, November 2.

"Roosevelt" wintered north coast Grant Land, somewhat north "Alert" winter quarters. Went north with sledges February *via* Heckla and Columbia. Delayed by open water between 84 and 85 degrees. Beyond 85 six days. Gale disrupted ice, destroyed caches, cut off communication with supporting bodies and drifted due east. Reached 87 degrees 6 minutes north latitude over ice, drifting steadily eastward. Returning ate eight dogs. Drifted eastward; delayed by open water; reached north coast of Greenland in straitened conditions. Killed musk oxen and returned along Greenland coast to ship. Two supporting parties driven on north coast Greenland. One rescued by me in starving condition. After one week recuperation on "Roosevelt," sledged west, completing north coast Grant Land, and reached other land near 100th meridian. Homeward voyage incessant battle with ice, storms, and headwinds. "Roosevelt" magnificent ice fighter and sea boat. No deaths or illness in expedition. PEARY.

The United States, therefore, holds the record of "farthest north," 87 degrees 6 minutes. The Arctic explorer failed to reach the North Pole, as he had confidently hoped to do with his specially-constructed vessel, the "Roosevelt," but he penetrated nearer to the Pole than the Duke of the Abruzzi's expedition, which had held the Arctic record, 86 degrees 34 minutes.

The best previous records are:

Duke of Abruzzi, 1900	86.34
Fritjof Nansen, 1896	86.14
Robert E. Peary, 1902	84.17
A. W. Greely, 1882	83.24
C. S. Nares, 1876	83.20
W. E. Parry, 1827	82.45
C. F. Hall, 1870	82.11
Julius Payer, 1874	82.05
Walter Wellman, 1889	82.00

Peary planned to have his headquarters 350 miles north of Cape Sabine. From that point he intended to make his actual journey to the pole, a distance of five hundred miles, across a desert of ice and snow. This final dash he expected to make in a month or six weeks from the time he left headquarters.

Peary's experiences will at least serve to dispose of Capt. Nares's views of a paleocrystic sea—views first formulated after Nares in 1876 had entered the ocean north of Grant Land, and based on the discovery of "floebergs" and floe ice as much as thirty miles in area and often fifty feet thick. It was argued that this sea, covered with enormously thick ice, was of great extent, and also that it was a shallow sea, and it was believed that most of the floes grounded on the bottom. Because of these formations, thought to be due to the unmelted accumulation of Arctic snows, this region of the Arctic Ocean was christened by Nares the "Paleocrystic Sea." Many of the floes were supposed to be centuries old. If sledges could be drawn over these floes, there would be a very stable foundation to travel over, not likely to float away and leave some explorer in the lurch who should happen to get between the paleocrystic ice and the North Pole.

The ice that Peary met was not grounded on the bottom of the sea, for anchored in this way it could not have drifted off to the southeast on the persuasion of a high wind, giving Peary and his belongings involuntary transportation to Greenland, which was just where he did not care to go.

We heard early last summer that the winter had been unusually mild in all parts of the Arctic from which reports had been received. Peary's report seems to show that these conditions prevailed very far to the north in the American Arctic. This fact may have had a large influence in disintegrating the Arctic ice, so that it was more easily broken up by great windstorms.

Peary, by actual experience, has put an end to this theory of enormously thick ice covering a large part of the Arctic Sea, to the north of America. He found the ordinary floe ice thick, but not ancient.

The ice of the sea to the north of Grant Land is no more stable than it is to the north of Asia and Europe, where the "Fram" drifted for many hundreds of miles to the northwest and where Capt. Cagni, of the Abruzzi expedition, drifted some sixty miles to the west when he was trying to make a straight road back to camp after reaching his highest north.

The failure of the ice in the American Arctic Ocean to afford a more or less stable highway for a sledge expedition to the North Pole will probably destroy the last illusions as to the advantages offered by polar ice anywhere for sledge travel poleward. The American Arctic sea ice had not been fully tested in this respect until Peary went on this last journey.

The ice was broken up into big and little islands and was floating off to the southeast.

Peary achieved the highest north in spite of the fact that in the long run the ice as a sledge route failed him utterly as a route to the pole.

BREAKFAST FOODS.

There is such a bewildering variety of cereal breakfast foods on the market, with such differences in appearance, taste, and claims to nutritive value, that it is hard to make an intelligent choice between them. For that reason the bulletin by Dr. Charles D. Woods and Prof. Harry Snyder recently issued by the Department of Agriculture should prove of interest. True economy here, as with other kinds of food, depends upon the amount of digestible nutrients which can be obtained for a given sum of money.

Of the five cereals most commonly used for breakfast foods, oats contain perhaps the largest quantities of the important nutrients, with a fairly low proportion of crude fiber. Wheat ranks very close to oats in all respects, however, and even when prepared with the bran is freer from crude fiber. Many persons consider that the bran contains so much protein and desirable mineral matters that it should be retained in spite of the crude fiber which it contains. Digestion experiments indicate, however, that the crude fiber makes the whole material so much less digestible that more protein is actually available to the body when the bran is excluded. Moreover, the ordinary mixed diet probably furnishes all the mineral matters which the healthy body needs, so bran is not needed for this purpose. The bran-containing preparations should be avoided by persons of weak digestion, but are often useful in cases of constipation. Such differences are, however, too small to be of importance to normal, healthy persons, and all the ordinary varieties of breakfast cereals are wholesome. Individual taste must determine which are most palatable. Appearance, palatability, and relative cost will always and rightly be important features in the selection of all these cereal breakfast foods. Corn and its preparations are rich in carbohydrates and fat, but are slightly less digestible than the other cereals. Rice is poor in protein, but remarkably free from crude fiber, and consequently furnishes a large proportion of digestible carbohydrates. Barley contains a fair proportion of nutrients and is moderately digestible. All these differences in composition and digestibility are comparatively slight and may be disregarded by healthy persons living on the ordinary mixed diet.

Thoroughness of cooking is a factor which has a bearing upon digestibility. It not only makes the cereals more palatable, but also breaks down the walls of indigestible cellulose which surround the starch granules and other nutrients and produces other changes so that the digestive juices can work on the nutritive ingredients more effectively. Poorly-cooked cereals are less palatable than the same dishes well cooked and may cause indigestion and be really harmful. When the partially cooked preparations are used care should be taken to insure sufficient recooking before serving. The majority of the ready-to-eat brands are apparently thoroughly cooked.

In choosing between the various breakfast foods it must be remembered that a novel appearance and a quasi-scientific name do not necessarily represent any unusual food value. Unless something is added during the process of manufacture, all brands must have just about the same composition as the cereals from which they are made, as manipulation cannot increase the amount of food material, though it may modify its appearance and flavor. As far as the claims to pre-digestion are concerned, it is safest to assume that in at least the majority of cases the goods do not contain a much larger proportion of soluble—i. e., partially digested—starch than any thoroughly cooked cereal. Fortunately, the matter is of little importance to healthy persons, since they are probably better off for doing their own normal work of digestion. If any one is so ill as to need predigested food, he should depend upon the professional advice of a competent physician in selecting it. The predigested and malted cereals should be judged by the same standards as the others.

It should not be forgotten that breakfast cereals of all sorts are usually free from harmful adulterants and that, especially in the case of package goods, they reach the consumer in a clean, fresh condition.

The investigations made at the agricultural experiment stations have thus far failed to discover any uniform relation between price and nutritive value. The retail prices of breakfast cereals run all the way from 3 cents a pound for some of the plain meals sold in bulk to 15 cents or more for some of the ready-to-eat brands. The proportion of nutrients supplied, pound for pound, does not differ greatly. The partially cooked brands, usually medium priced, are certainly easier to prepare than the raw grains and may be more truly economical in households where time, labor, and fuel are scarce. In general, the ready-to-eat brands are higher in price than the partially cooked goods, though they have practically the same nutritive value, pound for pound, as other classes of cereal breakfast foods. The extent to which they should be used for their special flavor and the variety they give to the diet must be decided according to individual circumstances. It is only fair to add, however, that, whatever the relative food values of malted and unmalted foods, the cost of the former to the manufacturer is greater, and the increased price is to this extent justified.

In the selection of cereal breakfast foods the consumer may be guided by the results of analyses of disinterested chemists, by the digestibility as determined by actual tests, by cost, by taste, by economy, or by the observed effects of the goods upon individuals. It seems fair to conclude that the chemical composition, considered in connection with digestibility and cost, furnishes a satisfactory guide for selection, due attention being paid to palatability and individual preferences.

All things considered, the cereal breakfast foods as a class are nutritious, convenient, and reasonably economical foods and worthy of an important place in the diet when judiciously combined with other foods.

THE CURRENT SUPPLEMENT.

A description of the mastless steamer "Teucer" for freight-carrying traffic opens the current SUPPLEMENT, No. 1611. Teeming with wholesome advice is President Alexander C. Humphreys's address on the engineer as a citizen. Mr. C. F. Jenkin discourses illuminatingly on the advent of single-phase electric traction. A new process for electrically depositing copper has been invented by Mr. Sherard Cowper-Coles, a well-known English metallurgical chemist. A full description of his process is published in the current SUPPLEMENT, accompanied by clear illustrations. Prof. R. S. Hutton gives a very excellent account of recent inventions in the electrical metallurgy of iron and steel. Mr. H. P. Fairchild takes up Shop Photography as his subject. A good description is given of how platinum is mined in Russia. Most valuable to the alcohol producer is Dr. H. W. Wiley's excellent discussion of the sources of industrial alcohol. "Coal Mine Explosions: Their Causes, Prevention, and Methods of Rescue," is the subject of a very clear article. Mr. Richard Schelies writes on some experiments with a beating-wing flying machine of his own invention. The work of the Weather Bureau and its relation to transportation is outlined by Mr. Edward H. Bowie.

THE NUMBER OF WORDS AND LETTERS IN THE BIBLE.

The number of words in the Bible and the number of letters was ascertained in three years' work of a painstaking compiler and given to the world in Horne's "Introduction to the Study of the Scriptures." The figures refer to the King James version:

	Old Testament.	New Testament.	Total.
Books	39	27	66
Chapters	929	260	1,189
Verses	33,214	7,959	41,173
Words	593,498	181,253	774,751
Letters	2,728,100	838,380	3,566,480

The similar record for the Apocrypha is: Books, 14; chapters, 183; verses, 6,031; words, 125,185; letters, 1,063,876. Similar statistics are the following: The middle line is found in II. Chronicles, iv., 16. The middle verse is Psalms, cxviii., 8; the middle chapter is Psalms cxvii., and that is the shortest chapter as well. The shortest verse is John, xi., 35. The longest verse is Esther, viii., 9. In Ezra, vii., 21 occur all the letters of the alphabet save j.

A PREHISTORIC BURIAL GROUND.

BY HAROLD J. SHEPSTONE.

In anthropological circles considerable interest is being manifested in the ancient burial ground at Harlyn Bay, a little seaside resort on the north coast of Cornwall, England. Here a wonderful collection of prehistoric remains has been unearthed, the finest collection in fact ever discovered in any one spot in the whole of Great Britain.

In August, 1900, a private gentleman, Mr. Reddie Mallett, attracted by the quiet beauty of the spot—for at that time Harlyn Bay was almost unknown—purchased some three acres of land here for the erection of a dwelling house. During the work of digging for foundations and prospecting for water, a slate cist, or tomb, was unearthed at a depth of about fifteen feet, and therein was found an interment with characteristic ornaments and implements of a very early stage of civilization. Mr. Mallett at once communicated with various antiquarian bodies, and within a short time an influential committee was formed. They examined the ground, and were not long in discovering that the site was nothing less than a very ancient burial ground of the neolithic or bronze age.

Funds were raised for carrying out systematic excavations, which were conducted under the direction of the Royal Society of Cornwall. In all, their excavators opened no less than one hundred graves, going down to a depth of 15 feet and removing no less than 2,000 tons of blown shell-sand which had accumulated on the spot. The find was the richest in the number of stone cists, skeletons, and their accompaniments that has ever been discovered in any one spot in the British Isles, and the burial ground naturally attracted wide attention, not only in anthropological circles, but also among the general public. It would seem too that there are many more treasures yet to be unearthed. Only a few weeks ago the present proprietor of the place, Col. Bellers, discovered another cist, while during the spring of this year he has found a number of ancient slate implements and other relics.

Nearly all the skeletons and the objects found in or near the graves by the excavators of the Royal Institution of Cornwall were removed to the Truro Museum, but quite a large number has since been found and is now to be seen in a specially-equipped museum on the spot, while some six cists in the burial ground have been roofed over with glass, to enable the general public as well as anthropologists to view them. Hence the Harlyn Bay Prehistoric Museum is one of the quaintest in the United Kingdom, and thousands from all parts of the country travel to Harlyn to see it.

The Harlyn Bay Museum was founded by the late proprietor, Mr. Reddie Mallett. In it there are some twenty cases, as well as a complete cist with a skeleton exposed. To describe in detail the various relics in the cases would occupy too much space. They include spindles, whorls, rings, bracelets, beads, and brooches found with the skeletons. In addition to the above there are numerous slate, shell, and flint implements. At present a prejudice exists in the minds of some against the belief in the quaint workmanship of the slate implements, it being urged that they are merely pieces of sea-washed rubble. No such relics are to be found in the beach, however, although if they were, the fact would be but parallel to the frequent occurrence of abraded neolithic flakes that have been found in other parts of Great Britain, in the neighborhood of Lowestoft, for instance, and other places. But one has to remember this fact, that the sand in the immediate neighborhood of Harlyn Bay is composed of comminuted shell-fragments, in themselves too soft to grind slate into "implements" with well-developed edges, even if such irresponsible agencies as sand grains could do so. Then some of the slate fragments found in the graves—for they have been discovered both inside and outside the cists—are naturally rounded and smooth, and have been seemingly placed therein because of their fanciful forms. Again, some of them show decided attempts at rude ornamentation, such as the scratching of lines and even crude designs. That these flakes are "worked" in many instances there can be no reasonable doubt, as a glance at their shapes plainly indicates.

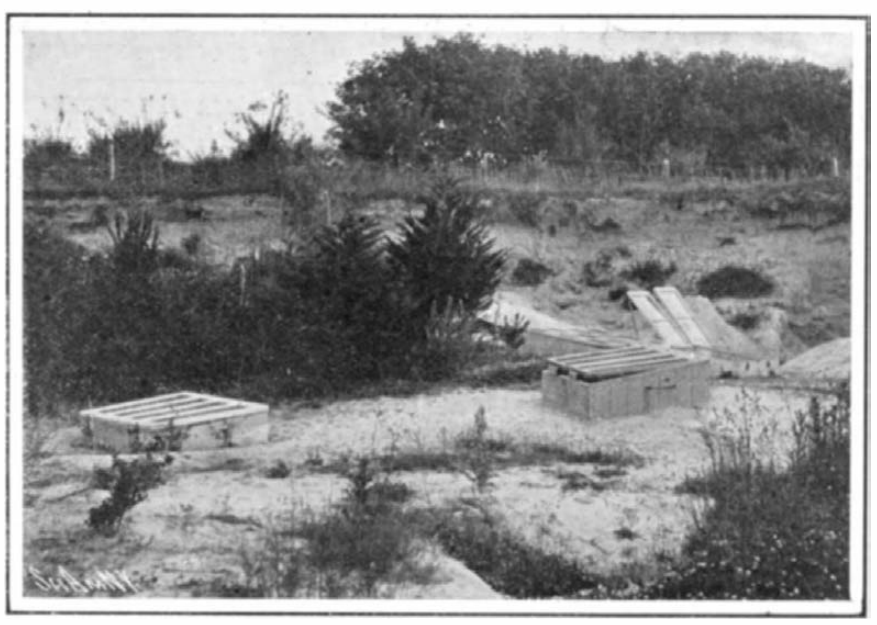
The Characteristic Posture of the Skeletons.

Looking Into One of the Slate-Lined Cists.

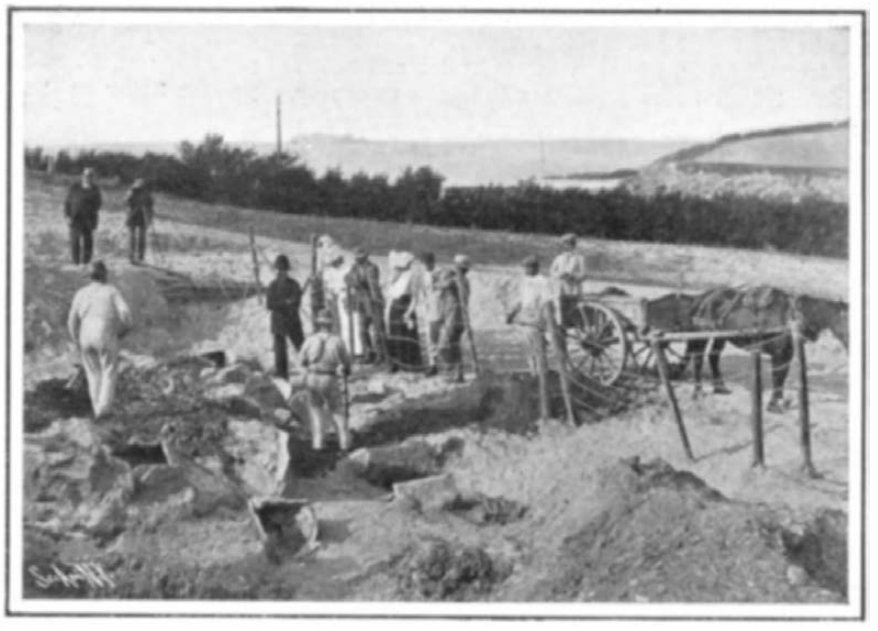
The museum boasts of a number of skulls, bones, a case of human teeth, etc., as well as the bones of various animals. At the time of the writer's visit there were eleven skulls in the museum, seven of which belonged to males, two to females, and of two the sex was doubtful. They were mostly of fair size and development. One skull which the writer measured had a length of 7⅛ inches and a breadth of 5⅛ inches. The cranial index in the males taken individually was 70.0, 72.54, 72.69, 76.18, 77.28, 78.61, and 82.22; in the females it was 73.41 and 76.60 and in the doubtful cases 75.28, and 77.22; the average of the eleven being 75.64. One could not help noticing the ape-like formation of the heads. The forehead was low and receding, while the under jaw was broad and heavy. An examination of the bones makes it clear that the average stature of these ancient people was rather low. This is estimated from the length of what are called "the long bones," such as the femur, tibia, humerus, radius, and ulna. It is supposed that the average stature of the men was about 5 feet 4½ inches, or 1,635 millimeters, and that of the women, 5 feet 1½ inches, or 1,560 millimeters.

More interesting than the museum is the burial ground, which has the appearance of an untidy garden, with here and there a number of glass-covered cases. It is through these that one can inspect the cists or tombs with the skeletons in them. There are some six in all, some containing only one skeleton, and others two and more. They are in a sitting posture, with the knees almost up to the head, and the hands crossed or pointing up or down. In every instance the graves are in straight lines, one head to another, all running toward the north or south. There were many lines of graves side by side, about three feet apart. Beneath these were other rows of graves. In every instance, too, the graves were lined with great slate slabs. It is not without interest to note that in one grave the skeletons are flattened. They must have been flattened before they were placed there. That is an indisputable fact. It is supposed by many that this is a proof that the people of those days indulged in human sacrifice. After the feast or religious rite, the remains, or rather the bones, of the sacrificed one were purposely flattened by some heavy instrument and then interred. Then in another grave the skull is broken in several places, and the nasal bone severed by a clean cut across the front. There are three teeth out of position projecting through the side of the left ramus of the lower jaw, beneath the normal row of teeth. This is supposed to show that these people were in the habit of hastening the end of a dying person by killing him either in the grave or on the naked rocks by breaking his head with a stone.

As to the age of these prehistoric remains, there would seem to be now no doubt that they belong to the neolithic period, and anthropologists are virtually agreed that the skeletons recently found must have been buried 2,500 years ago. It may even be earlier still. One popular writer has stated that the cemetery must have been founded at the time of King Solomon; but this is mere conjecture. Objects found with the skeletons, such as spindles, rings, bracelets, beads, brooches, etc. were submitted to Sir John Evans and to Mr. Read, of the British Museum, London, for their opinion as to their age, and several of the skulls were sent to the eminent craniologist and anthropologist, Dr. John Beddoe, F.R.S., for a like purpose. All these authorities are agreed that the cemetery was no doubt a burial place of the neolithic age or bronze age. Dr. Beddoe pointed out that the skulls represented people of a very old race, and were of a kind which existed before the rounded head of the bronze people. Only one appeared to be of a different variety. "As for the date of these deposits," wrote Dr. Beddoe in his report, "we may conjecture with some confidence that it was after the Gallo-Belgic and before the Roman conquest"—about 500 B. C. Dr. Beddoe also examined the teeth. He found the surfaces, particularly in the adults, excessively worn, which shows, he declares, that "these ancient people fed largely on grain or other coarse food. This would accord with the conclusion to be drawn from the absence of weapons and of notable



Glass-Covered Cases Placed Over the Cists.



Unearthing the Prehistoric Slate-Lined Graves.

A PREHISTORIC BURIAL GROUND.

wounds, that this was a peaceable and sedentary community, not a nomadic or predatory one." It is interesting here to note that not a single coin has been unearthed, which, as Sir John Evans, who made an exhaustive examination of the implements, said, "virtually confirmed the very ancient age of the cemetery. "The discovery of a single coin," he declared, "might have put a different aspect on the matter."

THE CAPE TO CAIRO RAILROAD.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

One of the most remarkable railroad enterprises that is at present in process of development is the construction of the railroad bisecting the African continent from Cape Town to Cairo. The scheme is rapidly approaching completion, from both the southern and northern termini simultaneously, so that what was considered purely a dream on the part of Cecil Rhodes when he first mooted his project gives every sign of becoming *un fait accompli* during the present generation. The southern road from Cape Town has already penetrated to the interior of the African continent, having reached a point about 374 miles north of the Victoria Falls on the Zambesi River and some 2,014 miles north of Cape Town.

The scheme was started in 1889. At that time the northern terminus of the Cape Colonial railroad system was at Kimberley, 647 miles from Cape Town. Mr. Rhodes decided to start from this point, carrying the track through the center of the African continent to link with the Egyptian railroad in the Soudan, and thus form a continuous track from the Cape to Cairo. This original scheme, however, has since been considerably modified, because in the interior of the continent the engineering difficulties that would have to be surmounted are so prodigious, that a continuous line could only be carried through those regions at an enormous expense, whereas by availing themselves of the excellent waterways offered by the various lakes lying in the line of the projected route, and linking them together with short spans of railroad, a combined railroad and water artery of communication through the continent equally efficient can be assured at much less cost.

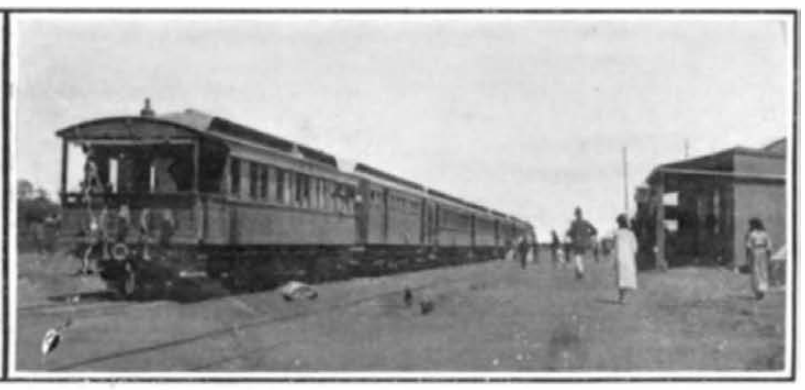
In regard to the character of the roadbed and track, in view of the fact that rapidity in construction was insisted upon, the builders were given full liberty to carry out this phase of operations in the manner which they considered to be the most desirable to attain the object in view. In laying the railroad, but little regard is paid to formation, the location following the surface of the ground pretty closely, and the cross-ties being packed up with a minimum of ballast, in order to give a moderately smooth running top. The second section of the road, extending from Vryburg to Mafeking, was originally laid with rails of 46¼ pounds to the yard, but was subsequently relaid with rails of 60-pound section, in order to correspond with the standard adopted on the north extension. For the 492 miles between Mafeking and Buluwayo, steel Vignoles rails were utilized in 30-foot and 33-foot lengths, of 60-pound section, connected by fishplates weighing 15 pounds per pair with four bolts to each joint.

Owing to the ravages of white ants and other termites, it was found impossible to use wooden cross-ties. Under these circumstances, the rails are laid upon steel trough cross-ties of the India state pattern, weighing 68¼ pounds each, and numbering 1,940 to the mile. These ties have been found to answer very well, and when well packed with ballast afford an excellent road, which can be easily maintained.

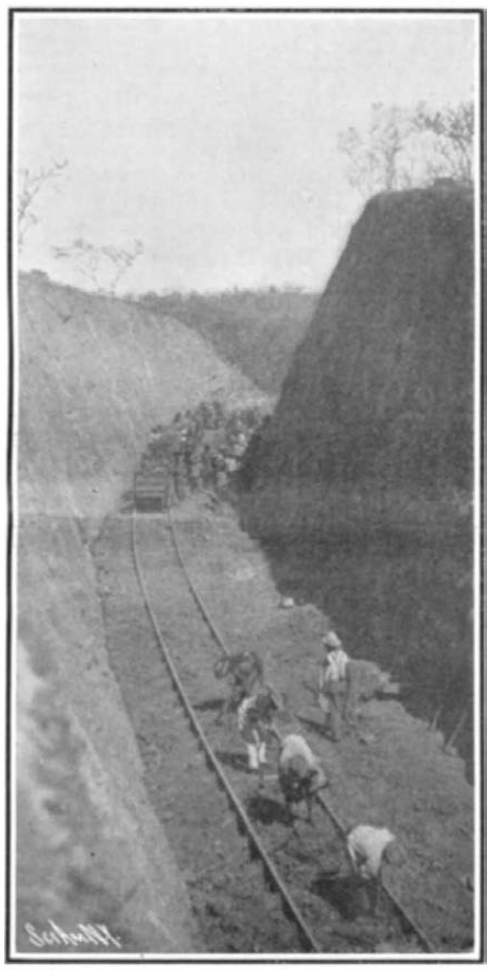
The greatest difficulty that has been encountered in the course of the constructional work has been the obtaining of adequate supplies of water. As far as

Temporary Wooden Water Tanks and New Overhead Cast-Iron Tank of 30,000 Gallons Capacity.

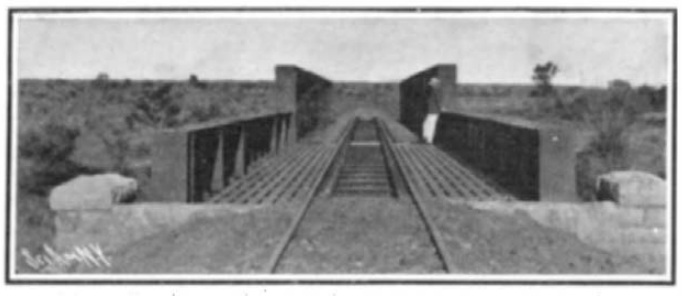
Standard Eight-Coupled Locomotive of the Cape to Cairo Railway.



The "Train de Luxe," Zambesi Express, Which Runs Between Buluwayo and Cape Town, a Distance of 1,736 Miles.



Typical Cutting in the Wankie District, 1,545 Miles From Cape Town.



The Umgusa River Bridge, 56 Miles From Buluwayo.

Typical Double Gangers' Cottage.

Type of Bridge Adopted for 50-Foot Spans on the Victoria Falls Section.

The Luxuriant Country Through Which the Road Passes After Crossing the Victoria Falls.

Construction Party North of the Zambesi River in Northwestern Rhodesia.

possible, water supplies have been established at intervals of 40 miles. As the railway was laid, these water supplies were pumped into huge wooden reservoirs, but as the traffic develops the wooden receptacles are replaced by cast-iron overhead tanks ranging from 20,000 to 30,000 gallons capacity, while concrete walls and dams are being constructed across the waterways, for the purpose of conserving the water during the dry season. The wet season extends from November to April, during which period the rainfall averages 24 inches. After leaving Kimberley, from which point the transcontinental railway commences, the road passes over the Vaal River near Fourteen Streams by a bridge 1,354 feet in length between abutments and built in ten spans of 130 feet in the clear. The girders are connected at their bases by cross-girders to form the roadbed, while each pair of main girders is also connected overhead by four arched girders. During the Boer war this massive structure was blown up by the Boers, but was replaced in 1901.

After leaving the Vaal River the line makes a steady climb to the high plateau of Bechuanaland, which it traverses at an altitude of 4,000 feet above sea level to Mafeking. Upon this section no bridges were found necessary, while the tangents are long and the grades easy. The ruling gradient is 1.25 per cent uncompensated for curvature, of which latter the maximum is 6 deg. The soil is sandy with granite underlying. The grass grows luxuriantly and prolifically, the trees being sparsely dotted over the veldt, which is inhabited principally by aboriginal natives.

Sixteen miles beyond Mafeking the road passes over the border of Cape Colony in the Bechuanaland Protectorate, and still rises for a considerable distance, there being many stiff climbs. The country is thickly wooded, and on the lower levels the soil is sandy. After attaining a maximum altitude of 4,400 feet the road drops 1,400 feet to 3,000 feet, at which level it extends for nearly 300 miles to Buluwayo. On this section the greatest difficulty confronting the railroad engineers has been in respect of water. Supplies are very scarce, and the reservoirs which have been established are perforcedly placed at long intervals apart, and to aggravate matters even these supplies occasionally fail entirely. The principal waterways are the Mahalapye, Macloutsi, Shashi, and Tati rivers, which are quite dry for the greater part of the year, but which during the wet season run very strongly.

At a point near Plumtree, 419 miles north of Mafeking, the railroad passes into southern Rhodesia, and has now a tortuous climb to an altitude of 4,400 feet to Buluwayo, at which level the important town and capital of Rhodesia is situated. On this last stretch a greater number of short-span bridges and culverts have had to be constructed than on any other section up to this point, while the percentage of curves is much higher. The curves are generally of 4 deg., while the ruling gradient is 1.25 per cent. Between Mafeking and Buluwayo the country through which the road passes is peopled almost entirely by natives, there being only one white settlement at Francistown, 364 miles from Mafeking, where the government administration offices are located, together with a rapidly-rising mining and trading community. The railroad enters Buluwayo from the west, and after leaving the town falls steadily for 1,200 feet to the Gwaai River, which is 89 miles distant from Buluwayo. More sandy and thickly-wooded country is here encountered, and owing to the peculiar configuration of the ground, it has been found possible to lay the road in a perfectly straight line for a distance of 71 miles toward the Zambesi River. Still falling between hills and through thick bush, the Wankie coalfields are at last reached at the comparatively low level of 2,400 feet. In the last 50 miles of this section several engineering difficulties were encountered. Up to this point the engineers had successfully obviated the necessity of heavy deep cuttings and high embankments, but in this stretch such undertakings could not be avoided. The ruling gradient, however, was still retained at 1.25 per cent with curves of 4 deg. After leaving Wankie the country rises steadily toward the Zambesi River, and it was found necessary to increase the ruling gradient from 1.25 to 2 per cent, though the curves were easier, being of 6 deg. The summit of the climb is attained when the watershed of the river is gained, some 13 miles from the southern bank, and at this distance the spray of the falls rising to a height of 3,000 feet is plainly discernible. The river station is just below the falls and about 282 miles north of Buluwayo, and the gorge is crossed by the single-span bridge, from which a magnificent broadside view of the river rushing over a gorge 400 feet in width and of a similar depth is obtained, the railroad itself being often immersed in the spray.

At the point where the bridge sweeps across the gorge the latter is 650 feet in width, and the height from the rail level to the surface of the water below in the dry season is 400 feet.

The bridge consists of a single span 500 feet in length, the arch being 15 feet deep at the center and 105 feet at the springing, while its rise is 90 feet.

From the northern bank of the river the railroad engineers made their way northward, Kalomo, the capital of northwestern Rhodesia, 92 miles distant, being the objective. This part of the undertaking was especially arduous, as the country was practically unexplored, and the surveying party some hundred or more miles in advance of the railroad experienced terrible privations and hardships. They had to cut their way through the thickly-wooded country and dense vegetation. From Kalomo the line wends its way for a further distance of 282 miles in a northeasterly direction to the Broken Hill Mine. The tapping of this district will have a decided effect upon the prosperity of South Africa, since it is unusually rich in deposits of zinc, lead, and copper, while immediately beyond the land abounds with vast supplies of India rubber. The copper deposits are abnormally rich. In past times there have been taken out of the hills copper ore in two parallel cuts, one about 12 feet wide and the other 5 feet in width, and both cuts run close together for a distance of 3,000 feet. Under the hills are caves of green malachite, which is also richly impregnated with this mineral.

On this section of the road the engineers carried out a smart piece of work, which is additionally remarkable in view of the fact that native labor is being exclusively employed. A French railroad engineer, who had been engaged in constructing railroads in French West Africa, visited the railroad, and refused to believe that the road could be laid at the rate of a mile a day, which is the average speed of construction, remarking that half a mile was the maximum. In order to demonstrate to the French engineer the methods adopted upon the transcontinental railroad, the natives set to work and laid a quarter of a mile of track in twenty minutes, following up this achievement by completing 5¾ miles in ten hours.

At the present moment there are over 2,000 miles of track open for traffic, and the traveler landing at Cape Town can proceed to a point 374 miles north of the Zambesi River without the least delay. There is a through *train de luxe*, the Zambesi express, which runs between Cape Town and Buluwayo weekly in each direction, and is so scheduled as to operate in conjunction with the arrival and departure of the mail steamers to England; while upon arrival at Buluwayo there is a train in connection which conveys passengers and mails northward as far as the road is open for traffic.

Simultaneously with the construction of the railroad, a telegraph line has been erected. This must not be confused with the transcontinental line, also inaugurated by Cecil Rhodes, and which is now practically completed, as the latter follows a different route from the railroad.

In the original scheme the projector stipulated that all stations and buildings should at first be regarded as simply temporary structures, and consequently they have been constructed of the lightest description and are of an inexpensive and portable character. Galvanized corrugated iron lined with match boarding has been largely utilized for this purpose. The wisdom of this step has been fully justified, since trade has in some instances developed at points where station facilities are not provided in the original plans, while in other cases the sites selected have proved too unhealthy. The removal of the buildings has consequently been considerably facilitated, and as the exigencies of the traffic are becoming better known, the frail structures are being replaced by permanent brick buildings.

The standard locomotives are of the eight-wheeled coupled driving wheel type, the drivers being of 4 feet diameter with a leading four-wheeled bogie. The cylinders are of 18½ inches diameter by 24 inch stroke. The tubes have a heating surface of 1,184 square feet, and the area of the firebox is 131 square feet, steam being supplied at a pressure of 180 pounds per square inch. The total weight of the engine and tender in working order is 120 tons, and the haulage capacity 500 tons. The tender capacity is 10 tons of coal and 27,000 gallons of water. The average fuel consumption per mile is 64 pounds Wankie coal.

The freight cars employed are of varying types according to the nature and volume of the traffic, ranging from small wooden bogie trucks of 25 tons capacity to steel bogie trucks of 34 tons. The passenger coaches are of the latest type, replete with every comfort and convenience, carrying first, second, and third class passengers. In the last-named coaches sleeping accommodation is provided for sixty persons. The average speed of the trains is 30 miles per hour in the case of passenger and 20 miles per hour for freight trains. The locomotive workshops and executive headquarters of the running staff are established at Mafeking. The town has been laid upon the latest lines, and the quarters for the staff are substantial and comfortable.

The line is being constructed throughout by unskilled native labor, of which a plentiful supply is available. They are divided into small gangs, each of which is directed by a white man, and their duties comprise plate-laying, excavating, coaling, portering, and such tasks, the finer work being carried out by white labor. The natives are paid at a uniform rate of 50 cents per day, and have been found to be eminently adapted to the work for which they are engaged. The ratio of white to native employees averages one to four.

Profitable Mechanical Invention.—II.

BY THALEON BLAKE, C.E.

(*Concluded from page 329.*)

Other causes besides the innate tendency of human ambition to drop substantials to run after big projects are responsible for this wasteful divergence of energy. Among them may be mentioned the fraudulent lists—I call them fraudulent because all their merits are more than counterbalanced by the harm they work, and have wrought, however unconsciously—which unscrupulous schemers publish to inveigle the unwary inventor, and to capture patent fees. Under some such caption as "Inventions Wanted," this bait is sent broadcast. These luring lists all purport to be composed of unsolved machines and other inventions of a value which must appear almost immense to a man working for small wages. Some of the inventions listed are of a doubtful utility, others have a fabulous value assigned them; many are old and some even unpatentable. This the novice cannot know offhand.

Now and then a *bona-fide* invention is wanted, and advertised for, by a responsible company; but generally, the cash prizes which are offered come from foreign governments, and invariably relate to improvements and discoveries valuable to their national industries. These, however, are very seldom, or never, enrolled in compilations of any kind, fair to dishonest, for free distribution to the gullible part of the public. In a true sense all inventions are "wanted," if needed; otherwise, not. And it is wisdom to assume that if any invention is really "wanted" badly, it will not be for a long time. The inventive spirit seems to be ubiquitous, and its manifestations sleepless, as wants of this nature are supplied quickly after they are discovered.

An untold amount of effort has been squandered because of deceptive lists, as any large employer of mechanics can soon verify. Even those devices that, theoretically, have a future use may be productive of much loss of time to experimenters. The man who can provide the novelty and department stores with "'taking" devices, from toys to useful appliances that win women's hearts and open their purses—like the latest wrinkles in skirt, hat, or hair fasteners, or similar baubles—is camping on the hot trail of big financial game.

To what, then, should an inventor, who does not secure a school training in mechanical engineering, nor expect to make of inventing a vocation—to what should he confine his inquisitive attention? The answer to this question conveys the Open Sesame that unlocks Aladdin's cave and bares all its treasures. It is : Give over the discoveries to the scientist, and the application of them to the technician, and invent along the line of trade, business, or professional interests, if with these you are familiar.

Some time ago a civil engineer of my acquaintance talked to an ingenious workman who had made for himself a little tool that was superior to any of its kind known to the hardware trade. It may be said justly of both, that the civil engineer became interested in the value of the tool; the workman had not a thought for its commercial value.

However, the workman had interests, and large ones. In twenty minutes' conversation he mentioned several things on which for days he had racked his brains. The catalogue of his grandiose conceptions alone will demonstrate the fertility of ideas which is so noticeable in our native mechanics. One of them was an emergency automobile brake, automatic and absolutely infallible; another was a keyboard attachment for the Italian harp, which did away with picking the strings; a third was a steering apparatus for a dirigible balloon, so simple and safe it could be operated by a child.

The workman grew enthusiastic on each of these in turn. Yet he had not a word to say for the humble tool. His brake, keyboard, steering device, may possess intrinsic worth; but he cannot know that without delay and expense. The little tool does possess intrinsic merit—but it is so common, so simple, that he cannot dream of any future for it. It is only a hand tool! And what is a hand tool in competition with human flying as an essay in invention for his talents and energies?—fudge!

There scarcely lives an intelligent human being in a civilized country who has not some time felt the need of an improvement in some of the daily used accessories of life. Improvements in household utensils, appliances for the home and office, novelties for men's and women's personal needs, apparatus for stores or shops, tools for the various trades, and mechanical aids for the farmers, are among the most

paying and easily sold inventions. When once thought of, their models are easy to construct and test.

In invention, as elsewhere, it is the little things that count, the little devices that pay, the little novelties that roll up fat royalties, the little improvements that are the real money-makers. The trouble is not in the little things, but in the workers who ignore them.

It is, indeed, axiomatic that, in invention, the simple things pay best of all. No costly machinery was needed to model the first return ball, to make the first metallic shoe-tip, or to construct the little sliding ring that holds the ribs of an umbrella, the removable cake-pan bottom, or the thousand and one well-known and profitable inventions. No great amount of training or inventive ability was displayed in any of these. They were simple, they were easy to make, they were useful, or they appealed to the public's appetite for novelty. Things sometimes sell for no other reason than that they are different or strange. Mechanically, they may not be one whit better than the devices that they temporarily supplant. But being new, they sell well, and satisfy for a time.

Yes, this "everyday" life is the field, here the harvest, here the numerous opportunities ready to hand for the occasional inventor.

The farm boy starts out, when inventing, by giving his attention to the time-honored churn. If the old family churn, unfortunately, has no wheel, he considerately supplies one; if it has but one, he haply adds two. Very well; the churn is not a bad thing to begin on, although it is a tremendously poor thing to end on. The boy is nearer success when he begins with a tool of whose use he has had experience, than the mechanic who begins with airships or with monocycles. And the boy's experience gains in significance from the bitterness of it, when he is compelled to churn though the streams are singing, and the woods are calling, calling to him. For many are the inventions which are rooted in human inconvenience or misfortune.

Practicability is the keystone that supports the arch of the inventor's success. The end to be attained must ever be in view, and no richness of ability or means sacrificed where simplicity will do.

The patient, long-suffering hen receives as much encouragement to add her small quota to the world's stock of breakfast food, from the ancient door-knob that jabs her breastbone and illusively slips around her goodly trotters, as she could from a fifty-dollar cut-glass nest egg, engraved with a legendary pedigree of a prize-winning breed of Leghorns. It is possible to overwork ideas like the churn and the nest egg. In fact, simplicity, practicability, utility, are the "tee-y-ties"—the trinity of the inventor's creed.

To recapitulate: let shop-worn ideas alone; stick to what you know. Trespass not in those old fields that have been passed over from the loving care of the originators to the first modifiers; from the first modifiers to the improvers of detail; from the improvers of detail (who were the last well-equipped toilers to conscientiously study them) to the heavy-eyed oxen and Don Quixotic donkeys. But work in those fields in which education of whatever degree, or kind, is available to prompt one to use one's self—those fields organic, pregnant with suggestion; those fields that, because of the personal relation, are to each individual always new and always tillable.

And now comes the final example, which sums in its suggestiveness all the truths to which this display of word, phrase, sentence, and paragraph has been tending; a leading example of how each man has endless opportunities to invent always beside him as he goes about his daily employment.

The steel drag scraper was not invented by an academical student. It might have been, of course. Some philosopher, or scholarly man of books, might have been ruminating on likely ways to benefit himself, or to confer blessings on toiling humanity, and incontinently let his intent gaze fall for a moment on the old-time scraper, and might immediately have seen the invention complete, pictured to the eye of his imagination. The great theories and epoch-making discoveries are mostly to the credit of scholars. Not so the practical, bread-and-butter inventions, such as are more apt to put money into empty pockets. Not so the steel scraper, which was invented by a practical contractor who had used wooden, iron-edged scrapers, and had found them to be deficient both in ease of handling and in wearing qualities. He made an all-steel scraper, and would have made as well his share of the snug fortune that eventually came of it, if he had not, so he always averred and so his fellow-townsmen generally believed, been unceremoniously, if not unscrupulously, squeezed out of the patent, and ejected from the business, by his partner.

Then along came another practical mechanic, who lived in the same town, and saw this first factory grow. Himself was likewise innocent of college training, and all the pomp and pageantry of marshaled lore. He added wheels to the steel "drag" scraper, and, literally as well as figuratively, was thus enabled to ride from poverty to a comfortable financial independence.

This is not written with the intention of discrediting college education—far be from me such an obsession; but in mechanics, men must be level-headed, and thousands of men educated superiorly to these scrapermen—scholars who, unlike them, are too cultivated to condescend to murder the king's English without the slightest provocation whatever—are yet incompetent for any original assembling of mechanical motions.

Cases innumerable could be cited that parallel these. Every town has its own kinglets, who once walked but now ride, because of certain fortunate inventions that led to the organization of prosperous factories.

Correspondence.

The Flight of Birds.

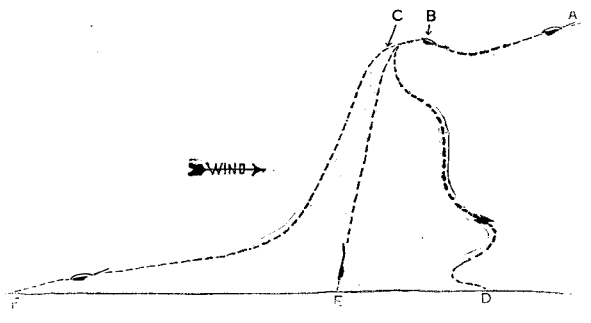
To the Editor of the SCIENTIFIC AMERICAN:

Special interest should be shown by aerial investigators in the recent article by Mr. M. Field, which appeared in this magazine. He has touched on a problem which is attractive, and which will stand a little more thorough treatment than he chose to give it.

In speaking of the resemblance between birds' wings and sails, he states correctly that they are both curved surfaces, but neglects the far more important fact that one is kept permanently arched, while the other is free to assume any shape the wind bids. That is the difference between a wing and a sail. Keep a sail at an angle to the wind which will fill it out and preserve its shape, and it will do business, but sail (or soar) too close into the wind with it, and its effectiveness ceases. With a gliding machine this is a very serious matter, for it will result in the machine's becoming utterly unmanageable and darting vertically to the ground. Of its own accord a machine of this model will never recover its equilibrium after such a disturbance. But we can expect better things of a glider with permanently arched carrying surfaces. In an emergency the first machine does one thing always, takes a sudden and precipitous short cut for the ground, but the better type of machine takes its choice of two. It may turn clear over and dart backward, or it may recover and glide on forward. A machine of the second model is bound to get on an even keel if it is able to stand the strains of the drop it needs to acquire velocity. The sail type of surface will do for motor-driven fliers, which will fly with the wings at a sufficient angle with the wind; but for the powerful mile-a-minute man, hawks, and the motorless soarers of the future, the permanently arched surface will be necessary.

LAURENCE JEROME.

Oak Park, Ill.



A, Starting point; B, machine meeting puff of wind; C, machine meeting region of calm; D, course of broken machine; E, course of machine with sail-like surfaces; F, course of machine with wing surfaces.

FLIGHTS OF GLIDING MACHINES.

Jet Propulsion for Fast Steamships.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 13, 1906, you have an interesting article on forecast and fulfillment on the rapid increase in size and speed of transatlantic steamships. In the article you speak of the steam turbine as a factor in the development of speed, and desirability of other factors, and ending with the statement "that perhaps after all the solution lies with the propeller; for if we could prevent the present loss back of the thrust block a 30-knot boat could easily become an accomplished fact."

I think the latter diagnosis of the steamship question is the nearest to the solution of the problem, and that if a propeller were adopted where the loss back of the thrust block could be obviated it would realize a 30-knot boat. Such a propeller is to be found in the jet or hydraulic method of propulsion, and it will be a success when once it is understood by those competent to experiment on a large scale. The jet thrust is direct, and every bit of water is doing effective work. The possibilities of the hydraulic propeller are great, and yet the steamship interests have been spending millions in less likely fields to obtain even slighter results.

J. W. H.

Boston, Mass., November 1, 1906.

PROGRESS OF AERONAUTICS IN FRANCE.

SANTOS DUMONT'S FLIGHT WITH HIS AEROPLANE, AND THE NEW DIRIGIBLE, THE "VILLE DE PARIS."

As already noted in our issue of November 3, Santos Dumont made a brilliant performance at Paris on the 23d of October with his new aeroplane. He succeeded in making a flight of some 200 feet, keeping at a distance of 10 feet above the ground all the while, and thus winning the $600 Archdeacon cup, which was offered for the first free flight by an aeroplane for a distance of 25 meters (82 feet). Such a flight with a motor-driven aeroplane has never before been publicly made. Our illustration on the following page shows the machine during its flight.

After the first flight of September 13, the aeroplane had to be repaired, and Santos Dumont decided at the same time to give it some slight modifications, which consisted mainly in the suppression of the third or rear wheel upon which it was mounted and the varnishing of the canvas surfaces. Otherwise, the main points of the apparatus remain about as we have already described. At present the weight, exclusive of the aeronaut, is 245 kilogrammes (540 pounds), and the supporting surface 60 square meters (645 square feet). Santos's weight is 110 pounds, which makes a total of 650. The eight-cylinder Antoinette motor weighs but 170 pounds and gives 50 horse-power. The propeller, which is direct-connected to the motor crankshaft and makes the same number of revolutions per minute (1,500), is 2 meters (6.56 feet) in diameter with a 1-meter (3.28 foot) pitch. At 1,500 revolutions per minute it gives 150 kilogrammes (330.69 pounds) thrust when the machine is stationary.

The completed apparatus was brought to the Polo Grounds of the Bois de Boulogne at 9:15 A. M. and first made a trial run, being pushed along the ground on its two wheels by the propeller, and apparently being very well balanced. In a second trial, Santos Dumont made a run of some 500 feet, and thought he was in condition to begin the flight, when unfortunately a broken bolt obliged him to stop. But by 4:30 in the afternoon he was again ready to begin. Messrs. Archdeacon and Capt. Ferber were on the ground representing the Aero Club in order to have an official control of the tests. At 4:40 Santos Dumont climbed into the basket and the aeroplane started, rolling along the ground. Accelerating the speed, it began to mount in the air with an easy and gradual movement and rose to the height of 10 feet or so, after which it kept moving along in a straight line above the heads of the spectators. Naturally this performance awakened great enthusiasm. Santos continued to fly for some distance, keeping a good balance. Then the aeroplane had a tendency to turn to the left, and, not wishing to go too far out of the way, he brought it to a stop by cutting off the ignition current. The aeroplane alighted rather suddenly, and the shock was enough to break the wheels, but this was of small importance. The flight of 200 feet was accomplished at a speed of about 25 miles an hour. Santos thus won the Archdeacon cup and made the first public flight with a motor-driven aeroplane. The varnishing of the cloth is said to have had a good effect upon the carrying qualities of the flyer.

Santos Dumont expects to go on with his experiments, and he hopes to make a flight of 100 meters (328 feet), in which case he will be entitled to the $300 prize for this distance. After that he will make an attempt to win the Grand Prix offered by Messrs. Deutsch and Archdeacon of $10,000 for the first heavier-than-air machine to make one kilometer (0.62 mile) in a closed circuit. The Aero Club Commission, in a subsequent meeting, confirmed the above performance, so that Santos Dumont is officially the winner of the Archdeacon cup.

If we take the motor of Santos's aeroplane at its full rating, he succeeded in lifting only 13 pounds to the horse-power. If we suppose, however, that it only developed 40 horse-power, the lift would then be 16 pounds to the horse-power, while at two-thirds of its rated horse-power (which was about what the Wright brothers' motor developed) the lift would be 20 pounds per horse-power. Consequently the later flyer showed less than half the efficiency of the Wright machine.

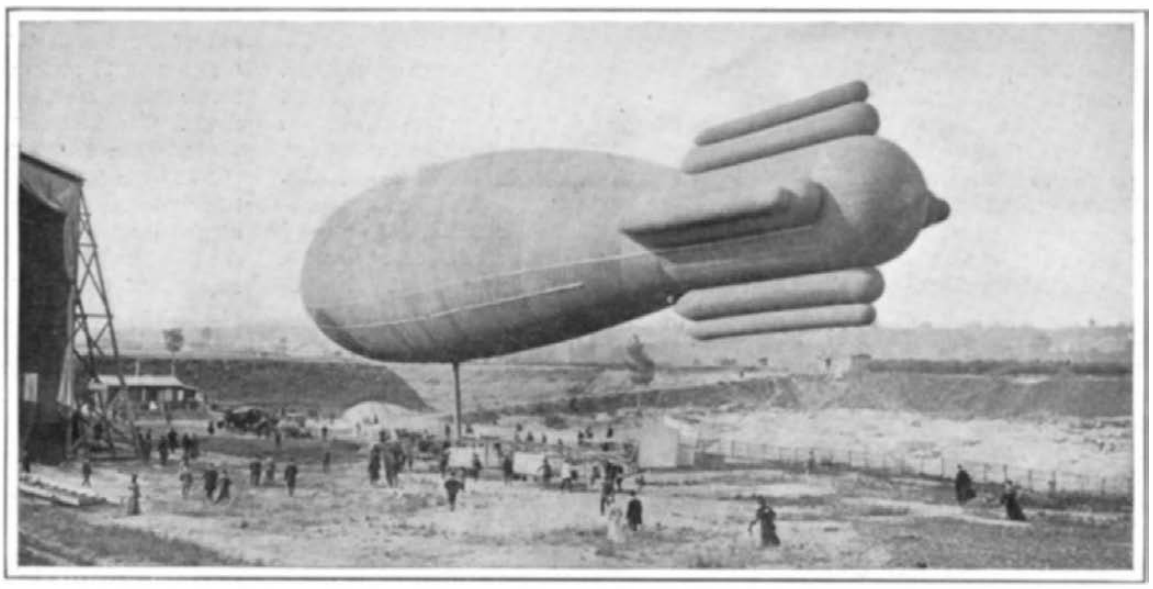
As the Wright machine lifted from 38 to 61 pounds per horse-power, according to whether the motor was taken at its full power or at two-thirds of its rating, we see that the new aeroplane showed only from one-third to one-half the efficiency as far as lift per horse-power is concerned, and not taking account of the difference in speed.

The apparent inefficiency of Santos Dumont's machine, which we commented upon in our November 3 issue, may be partly explained by the statement of a well-known American experimenter to the effect that in towing experiments with a full-sized aeroplane loaded with sandbags he found a variation in lift of from 55 to 185 pounds per horse-power due to the difference in balancing, etc., of the machine. This would indicate that the inefficiency of the Dumont aeroplane may not be due entirely to its form, but that improper balancing, too great an angle, etc., are the chief causes.

Another aeroplane with which experiments are being conducted in France is that of M. Louis Bleriot, which was illustrated in the Scientific American of August 18, 1906. Experiments with this machine are being conducted on the Lake of Enghein. The aeroplane has two propellers which are turned in the opposite direction, and each of which is direct-connected to a 24-horse-power eight-cylinder motor of the same make as that used by Santos Dumont. The apparatus is mounted upon cylindrical floats of canvas which are pointed at their ends. When it attains a sufficient speed these floats leave the water and the apparatus soars in the air. It is controlled by a double horizontal rudder in front, and also by suitable vertical rudders at the rear.

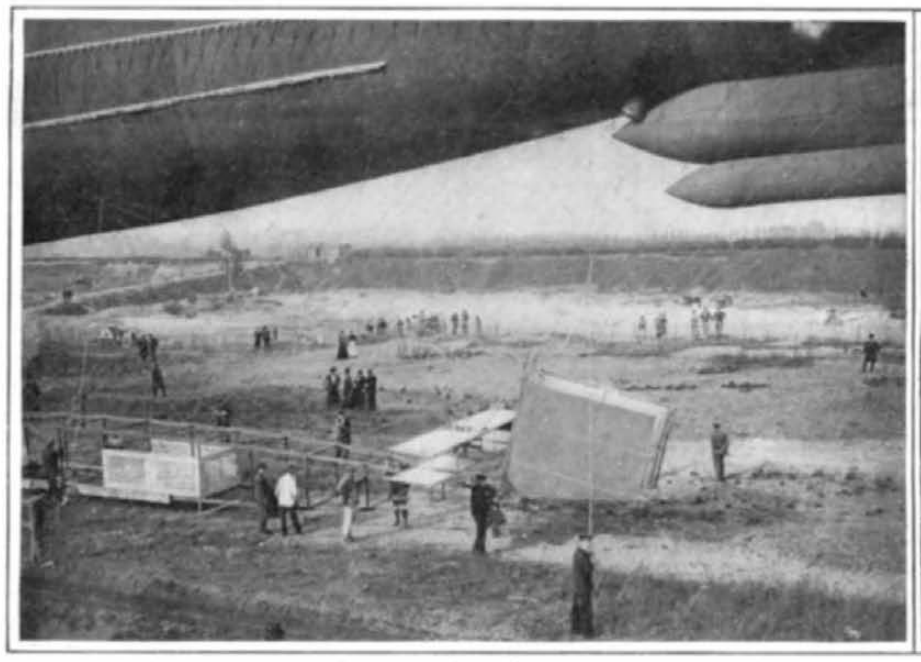
In opposition to the aeroplane or heavier-than-air type of flying machine, the French are particularly active just now in constructing large dirigible balloons. The latest of these is M. Henry Deutsch's airship, the "Ville de Paris," which is a trifle larger than the new Lebaudy airship that has recently been constructed for the French government. This latter airship has a length of 60 meters (196.85 feet) and a diameter of 10.8 meters (35.43 feet), while its capacity is 3,000 cubic meters (105,943 cubic feet). Its propellers are placed on either side of the body framework or "nacelle," and at about the center of the latter, which is boat-shaped. The weight which can be carried, outside of the equipment and the fuel sufficient for a ten hours' run, is about 1,100 pounds. A 70-horse-power Panhard motor is used, and as the power of the motor is considerably greater than that of the motors used heretofore, a much higher speed will be possible, and the radius of action of this new government dirigible will be considerably increased. It is expected that the first trials of the new Lebaudy airship will be held this month. This is the second dirigible balloon which the French war department has had constructed. We publish below and on the front page a number of photographs of the new airship "Ville de Paris." This dirigible is 62 meters (203.42 feet) in length and has a diameter of 10½ meters (34.45 feet). Its capacity is 3,200 cubic meters (113,005 cubic feet). It is built of double rubber-coated tissue, lined with an interior protecting coating. The balloon is constructed according to the late Col. Renard's theories, and is cigar-shaped, terminating at the rear in a cylindrical portion. The envelope is so designed and put together that there are no longitudinal seams. What seams there are are so arranged as to be relieved of heavy strains. The peculiar arrangement of cylinders placed at the rear end of the balloon is one of its original features. These cylinders are made up of canvas tubes filled with hydrogen and attached to the main body of the balloon. The cylinders are intended to form a kind of balancing tail. The framework below the balloon also carries a double vertical rudder for steering and a double horizontal rudder for directing the airship upward or downward. This framework is 105 feet long and carries a four-cylinder Argus gasoline motor of 70 horse-power at 900 revolutions per minute. The engine is geared to the propeller shaft with a reduction of 5 to 1. The propeller is placed at the front end of the framework, and is of a new design, having two blades which can be readily turned in the hub and which are automatically set at the proper pitch according to the thrust and speed of the propeller. The balloon is fitted with a large compensating ballonette into which air is forced from a blower seen in one of the illustrations, allowing for the expansion or contraction of the gas, and keeping it always at the same pressure. The blower is connected to a gasoline motor. The purpose of the ballonette is to compensate for the expansion or contraction of the gas in the balloon (which is due to the difference in temperature of the atmosphere) by allowing air to escape and by blowing it into the ballonette. This new airship is one of the largest and most improved craft. It is expected that a speed of 20 miles an hour will be attained.

On the 11th ultimo Count Zeppelin maneuvered his new dirigible above Lake Geneva, ascending to a height of 2,500 feet and steering the huge cigar-shaped aerostat very nicely. This airship is mounted on floats, so that it works equally well on the water.



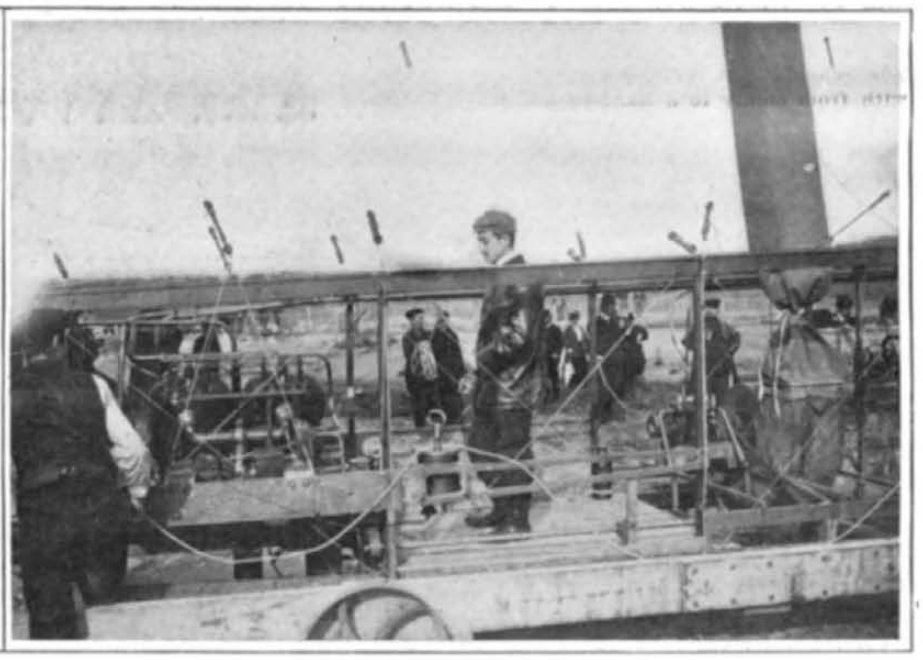
The New Deutsch Airship "Ville de Paris," the Latest and Largest Dirigible Balloon.

The peculiar arrangement of twin, hydrogen-filled cylinders forms a sort of balancing tail.



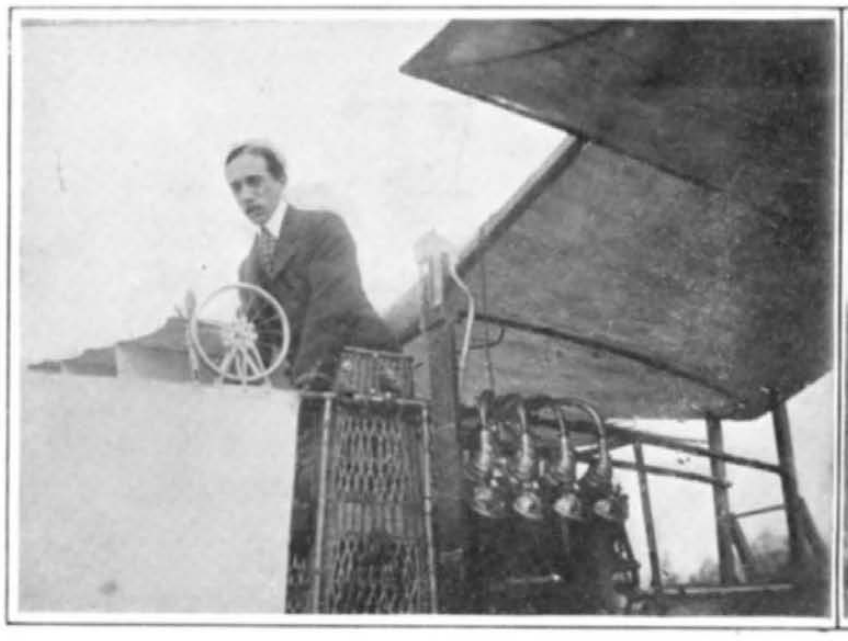
Under Side of the Balloon Toward the Rear.

In this view the "nacelle," or body framework, is shown. Note the double horizontal and vertical rudders at the rear.



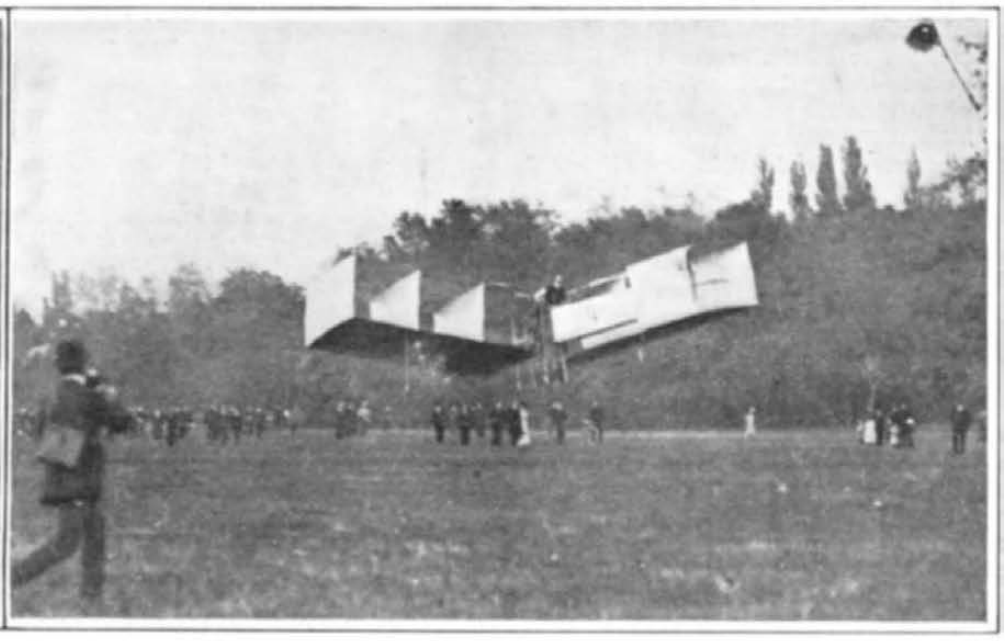
The Power Plant, a 70-Horse-power, 4-Cylinder, Water-Cooled Argus Motor.

The motor drives the 19.68-foot propeller through gears at 180 revolutions per minute. A smaller motor runs the blower (seen at the right) for keeping the proper air-pressure in the compensating ballonette.



Santos Dumont in the Basket of His Aeroplane "14-bis."

Note the control lever and wheel for the box rudder in front. The 50-horse-power motor is just back of the basket.



The Aeroplane Making Its First Successful Free Flight With Its Owner in Control.

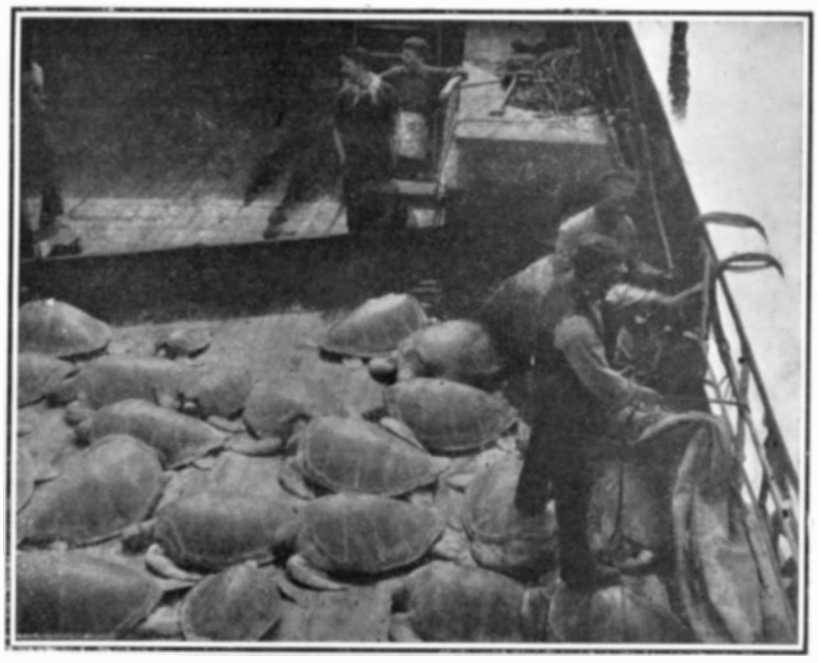
The machine flew about 200 feet at an elevation of 10 feet from the ground.

PROGRESS OF AERONAUTICS IN FRANCE.

THE TURTLE TRADE OF THE WEST INDIES.

BY W. G. FITZ GERALD.

There are few more curious or profitable industries than that of catching and exporting the edible turtle for the benefit of the *gourmets* of the world, who love turtle soup, not to mention invalids and our weaker brethren generally, whose lives may be saved by this peculiar delicacy, which appears to possess nutritive properties of a very high order.



Turtles on Board Ship.

Appraising Live Turtles.

These appear to be due to the easily assimilable form in which the nitrogenous and gelatinous constituents exist in the flesh of the turtle. The trade itself is unique. Its headquarters are at Kingston in Jamaica, but most of the fishing is done on the coral reefs lying to the north of the island. Twelve or fifteen small schooners are employed, and upward of 120 men.

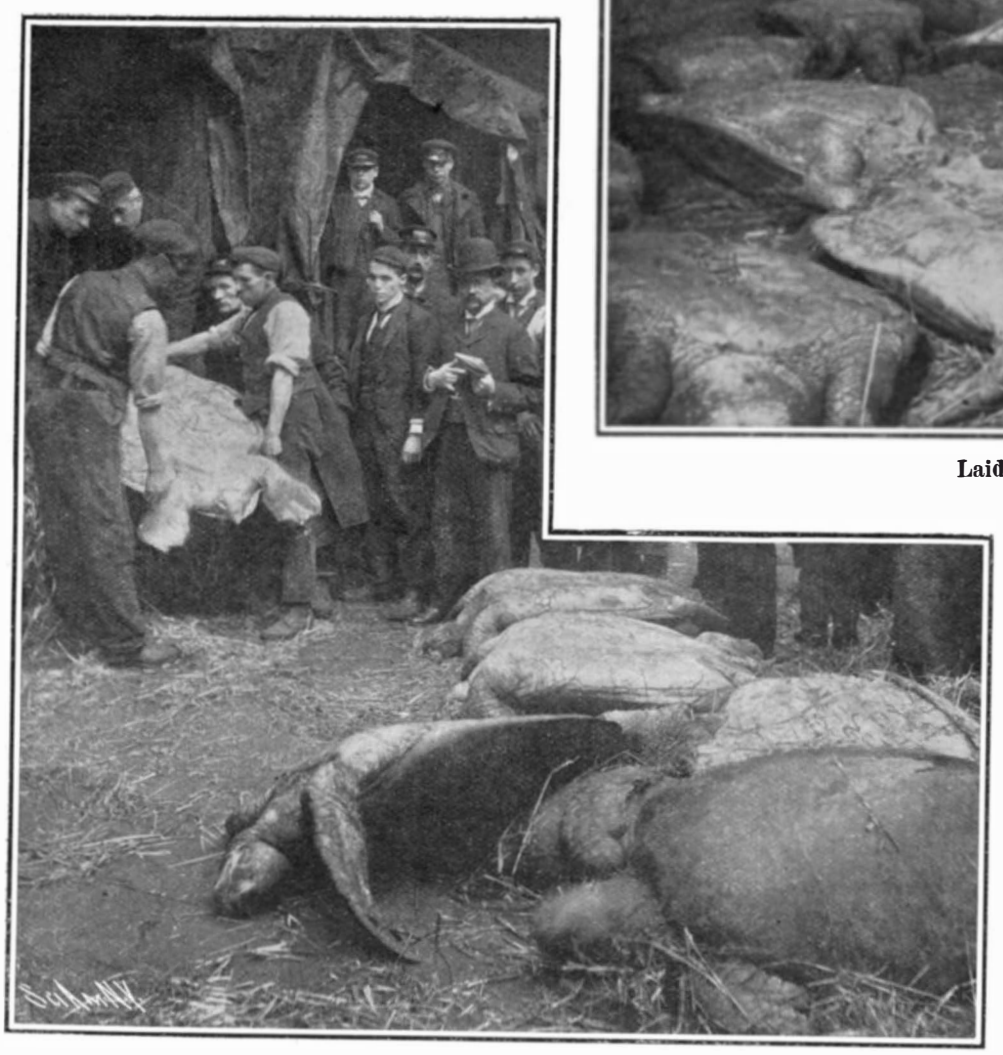
These fishers of strange "fish" (the turtle's technical name) stretch nets of twine from rock to rock, and the moment the turtle feels itself entangled, it clings tenaciously to the meshes. The schooners in due time return to Kingston with from eighty to a hundred and fifty of these queer "fish," which are promptly deposited in palisaded inclosures flooded by the sea, and here they are fed upon a certain kind of herbage known as turtle grass, and taken as required.

The true *Chelonia Mydas* is quite a small turtle of rarely more than 180 pounds, and the market is regulated artificially. For example, the one London dealer in whose hands the entire British trade is, instructs his agents in Kingston not to send more than a hundred turtles once a fortnight by the mail steamer arriving at Southampton.

Everything about these creatures appears to be abnormal. For example, they have three hearts, and the appearance of four. Moreover, bringing them over seas is as delicate a business as the case would be with a cargo of giraffes, and frequently 105 splendid turtles out of 120 have died *en route*, in spite of the most elaborate precautions, such as the constant spraying of salt water daily on board the mail steamer, and the use of luxurious foot warmers for the turtles in the wagons conveying them from the terminal railroad station to the dealer's warehouse. Most of the "fish" are sold in advance to *restaurateurs* of the highest class; and in England alone some 3,000 choice specimens are imported every year. The average weight of each is about 165 pounds, and the wholesale price ranges from twenty to twenty-five cents per pound. Although the turtle is seemingly very susceptible to cold, his vitality after decapitation by the *chef* in the kitchen is all but incredible. In one well-authenticated instance a turtle whose head had been cut off, and which had been hung upside down for upward of twenty-four hours, actually knocked down one of the men cooks with a spasmodic blow of its fin. Naturally, *chefs* have tried many curious experiments with this strange creature; and a turtle's head has been known to bite savagely at a piece of wood many hours after decapitation.

The flesh is divided into what are known as calipee, calipash, and fins. The flesh is said to be colored green by the peculiar grass that grows on the coral reefs where the turtles feed. The winter season is naturally the busiest for the turtle trade, and the parts used in the famous soup are the membranes of the stomach and back-shell. The shell itself of the green turtle is worth very little, but the hawksbill turtle yields what is popularly known as tortoise shell, and the armored covering of a good specimen may be worth $45.

Laid on Their Backs the Turtles Are Helpless.



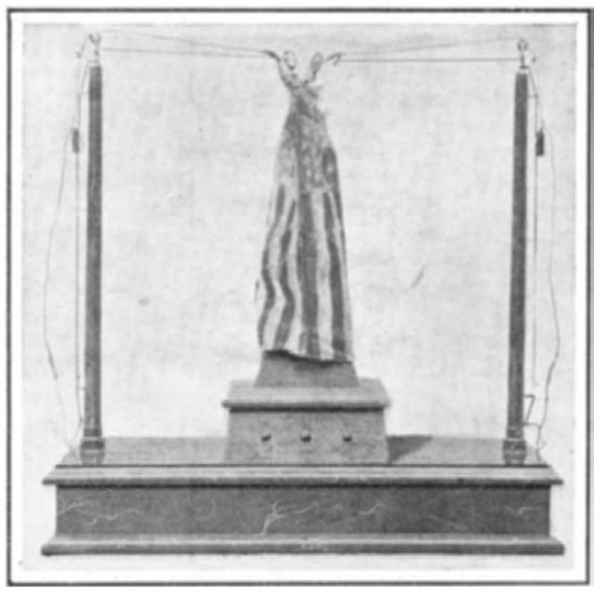
A Scene in a Turtle Market.

Of course, turtle range in size up to 600 pounds, but the flesh of very large specimens is too coarse and has no commercial value. A great quantity of the finest turtle are now caught in the Mexican Gulf, and beyond all question the flesh has been regarded as a very great delicacy from the remotest times of antiquity. As far back as the days of Pliny himself, we read of the shell being made into dishes, to say nothing of hair-combs for the Roman ladies.

A great industry is growing up in canned and bottled turtle products, quite apart from the live "fish." A visit to the cellars in which these huge creatures are stored is an uncanny experience. Here one may see a veritable menagerie of edible turtles, rustling about on a bed of sweet straw. From time to time they lift up their peculiar heads, and utter strange sounds like the faint, hoarse bark of a small dog. From time to time a telegram arrives from some great

caterer, announcing some important banquet, and one of the "herd" is forthwith cautiously dispatched to the scene of festivities, with as much care taken for his personal comfort *en route* as though he were the pampered pet dog of some great lady.

Beyond doubt turtle products are vastly cheaper today than they were ten years ago, because the famous



The Statue Covered.

calipee and calipash are now manufactured in portable form, mainly for the convenience of invalids and explorers venturing into malarial countries like the West Coast of Africa, where readily-made turtle soup is found a very powerful restorative in cases of debilitating fever.

There is little chance, however, that the turtle trade will ever attract investors, for not only is the demand extremely limited, but, as we have seen, all conditions appertaining to the supply are extremely precarious. In the nature of things, turtle soup must ever remain beyond the reach of the poorer classes, but it has for centuries figured at aldermanic banquets and great civic festivities, and we have evidence that Lucullus himself loved the luscious green fat, which has become synonymous with high living and an opulent table generally the world over.

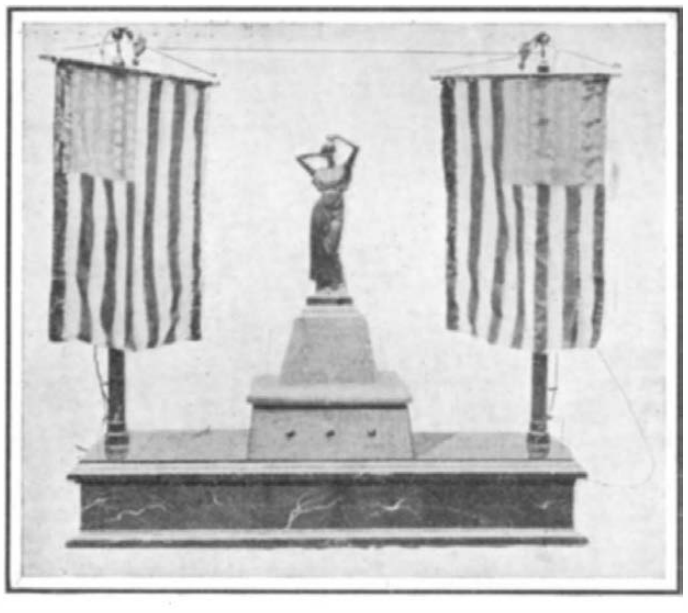
UNVEILING STATUES BY ELECTRICITY.

BY GEORGE J. JONES.

The unveiling of a statue under ordinary circumstances is a very impressive occasion, but it is frequently rendered ludicrous by a failure at a very critical moment. Often the drapery which is used to hide the lines of the memorial refuses to respond to the tugs and pulls given at the cords which were designed to draw the fabric away. This sort of mishap is no less embarrassing than when the material falls of its own accord in advance of the set time. Having witnessed several such accidents at Washington, D. C., J. S. Hill, an electrical engineer employed in the Department of the Interior, set about some time ago to devise some method of performing this operation by the use of the electrical current, so as to render such occasions free from accidents. Recently he announced the completion of his self-assumed task.

The scheme calls for the erection of two poles placed on either side of the monument, with a stout wire cable stretched from top to top. The ends of the cable pass down the side of one pole, and are secured near the bottom. Held slightly away from the pole, the cable acts as a guide for counterweights. Mounted on the cable are two swivel pulleys, each supporting a wooden staff balanced therefrom. Flags are generally made use of for the purpose of hiding the lines of the statue until such time as it is desired to reveal them to the assemblage, and in the electrical process the bunting is secured from these sticks. The flags hanging from the sticks completely encircle the statue. The lengthwise edges of the flags are supplied with small magnets and corresponding armatures, the magnets being connected in series, and the current from a few batteries is sufficient to hold the edges of the flags together, even in the face of a strong wind. This current is conveyed through a small insulated wire. When all is ready one of a pair of touch-buttons, placed at a convenient point, is pressed. The flags open like a book, and for a few seconds they remain as an effective background to the memorial. The second button is then pressed, and the flags move off under the action of the weights, toward the poles, leaving a free and unobstructed view of the statue.

The inventor of this scheme had an ambitious desire to put the scheme to a severe test at the unveiling of the Franklin statue in Paris. He submitted a plan to the American ambassador. His suggestion was that the ceremony be made a double one, the actual pressing of the button being done at Philadelphia, Pa., at the meeting of the American Philosophical Society, by some distinguished electrician who might attend the gathering or by some of the descendants of Benjamin Franklin, several of whom are still residing in that city. There was not sufficient time, however, to make the necessary arrangements, which would require much correspondence.



The Statue Unveiled.

UNVEILING STATUES BY ELECTRICITY.

Making Casks of Cork.

BY ARTHUR H. J. KEANE.

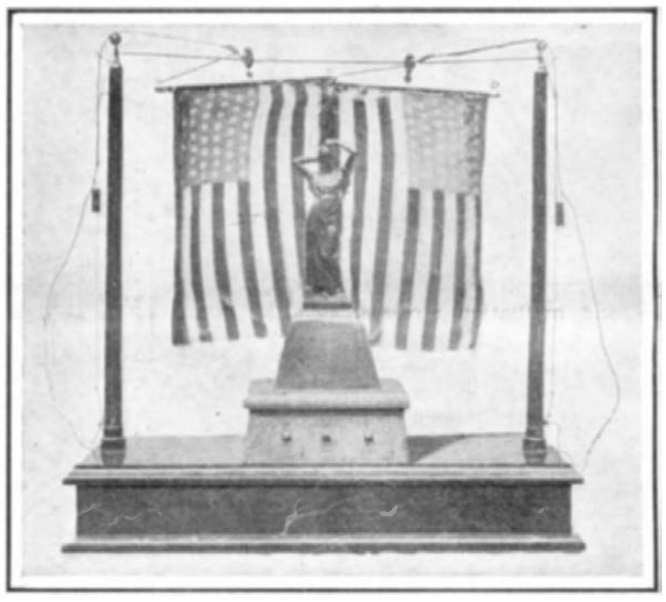
A great impulse to the cork trade promises to be given by the discovery of a new process relating to the manufacture of casks, barrels, and the like from the raw material in question. The process consists in placing staves made of cork edgeways instead of flat, as is usual when making casks of wood; in this way all cracks and holes traverse the stave in the direction of its width, thus assuring perfect impermeability, even with cork of inferior quality or of a grade not suitable for any commercial purposes. The staves, when assembled and hooped, are pressed together by means of a cooper's lathe or other suitable apparatus. The hoops are slipped on in quite a natural manner without the necessity for using a hoop-driver; they become imbedded in the cork, and are all the more adherent as, owing to the elastic nature of the cork, the body of the cask always tends to swell. The bottom of the cask is composed of strips of cork, also placed edgeways, and so joined together as to form a base of any desired thickness; upon this latter a circumference is drawn corresponding in length to the height of the cask. When placed in position, the pressure exerted upon it by the first hoop gives it both impermeable and perfectly solid qualities. Its rigidity may also be further enhanced if desired by placing across it a sheet of steel, a T-iron, or a wooden brace, the ends of which are made fast to the first hoop. A wooden bottom, covered with cork or not as preferred, may also be used with advantage, if no press of sufficient power to render the cork bottom impermeable is available. Any risk of mustiness or "corky taste" being imparted to the contents is prevented in the following manner: Before placing them in position the staves are steeped in boiling paraffine, and the inside of the cask is coated with a varnish similar to that now used for beer barrels. The heated air expands, and causes the coating to penetrate into the pores of the cork; the cask is then emptied, and the outside is given a good dressing with pitch, coal tar, or other substance that will harden cork. Casks and barrels of all sizes may be made in this way, by suitably cutting the cork. The average weight of such a cask is from 34 to 35 pounds, or one-third the weight of a wooden cask, so that costs of transport (especially as regards the return of empties) are greatly reduced. A cork and a wooden barrel were recently filled with water at 10 deg. C. and placed right in the eye of the sun; at the end of two hours the water in each was tested, and the temperature found to be 10 and 18 degrees respectively; after six hours' exposure the temperatures were 12 and 40 degrees in the cork and the wooden barrel respectively. In the shade water in a wooden cask became undrinkable at the end of two days, whereas the supply tested in a cork cask was quite fresh and sweet, and remained so after being kept under test conditions for a very long space of time. This is a point of vital importance in connection with the keeping and storage of wines, especially in warm countries, as cork affords a very efficient means of protection against fermentations of all kinds. This industry, though still in its infancy, is already giving most encouraging results in France, and a great future is forecasted for it.

Overhauling Brass.

When brass first began to be rolled it was not treated in any manner to remove the dross or other imperfections which were present on the surface. The customer was obliged to take the sheet metal in whatever condition it was. As the consumer became more critical, the so-called "overhauling" was practised, i. e., the scraping of the surface of the brass with a hand scraper. This, too, finally became unsatisfactory on account of the impossibility of removing all the imperfections. The old-fashioned Stever overhauling machine made its appearance, and for many years was the only appliance known to the brass rolling mill industry. Taking this for a base, the modern and very efficient overhauling machine has been evolved. Various attempts have been made to devise some more rapid machine, but without success.

For years it was the custom of the American brass rolling mill to overhaul all brass. It made no difference what it was, all went through the same process. Within the last year or two, however, there has been a tendency toward the partial elimination of the overhauling machine, and at the present time several of the large brass rolling mills have abandoned the use of the overhauling machine entirely on certain classes of work and are now rolling a proportion of their brass without any treatment whatever, except perhaps, first pickling it, and even this is dispensed with in many instances.

This practice was started in the commonest varieties of brass, and it has gradually spread to those of more importance, until now even drawing brass is made in this manner. The success of such practice depends, of course, upon the quality of the cast plate, but when care is used in making it, it is a matter of surprise to find how well it will work.



The Parting of the Flags.

There are many uses for brass which do not require the metal absolutely free from imperfections, and it is in these instances that overhauling can be dispensed with. As overhauling is also an inspection process, its elimination is apt to be attended with bad results unless much care is used in dispensing with it.—Brass World.

Cadmium Alloy for Bearings.

A new alloy for bearings has been patented by Hans Kreusler, of Wilmersdorf, Germany, in which the following are used:

Cadmium	45 parts
Zinc	45 parts
Antimony	10 parts

This alloy is stated by the inventor to have a very low coefficient of friction and to cast well. —Brass World.

Japanese Machinery Imports.

In turning lathes the United Kingdom and the United States practically divided the import for the whole of Japan last year, of which Kobe absorbed nearly all. In cotton-spinning machinery, of which about six-sevenths were exported by the United Kingdom, Kobe absorbed five-sixths of the British machinery and five-sevenths of the whole import from all countries. In turning lathes Germany advanced her total import into Japan by over 300 per cent, but the value remained at not more than one-fifth of the British and one-eighth of the American import.

A NEW REMEDY FOR SEASICKNESS.

The well-known traveler and writer Eugen Wolf says, in one of his books, that the best remedy for seasickness is the application to the head of a wet compress, as hot as can be borne. This suggestion, however, is difficult to carry out in practice unless the traveler is provided with a sea-proof servant or companion, for in a seaway the stewards are apt to be too busy to furnish fresh hot compresses, at short intervals, to all who are in need of them.

A device which enables the desired result to be attained without the steward's intervention has recently been put upon the market. It consists of a leather cap lined with a thick cushion of wet felt, which can be fastened very tightly about the head. The wet compress is kept hot by wires, which may be connected with the electric lighting system of the ship. Its effect is an increased flow of blood to the brain, and, therefore, the removal of the cerebral anæmia which is the cause of seasickness. This appliance has the advantage that the patient can enjoy absolute rest, as no renewal of the compress is necessary. As the compress is aseptic, it may be used for many patients, though the apparatus is not too costly or cumbrous to be carried by every passenger. Its effect is said to have been very beneficial in every case in which it has been employed, so that it would appear to be destined to come, very soon, into general use. The same prophecy, however, has been made in regard to many other remedies for seasickness, and has not been fulfilled.

A NEW REMEDY FOR SEASICKNESS.

A GASOLINE-PROPELLED ROAD ROLLER.

The accompanying illustration represents an interesting industrial application of the gasoline motor to a vehicle which possesses many prominent features. This is a 42-inch roller which is of sufficient weight to render it serviceable for rolling light roads and sidewalks or lawns, where the ordinary type of locomotive roller or lighter animal-drawn implement cannot be satisfactorily employed. As will be seen from the engraving there are two rollers, the front cylinder being connected to the steering column, while the rear cylinder, which is 42 inches in length by 36 inches in diameter, constitutes the main roller. The frame is of channel steel throughout, with a central member of T-section, and is of stout construction to insure complete rigidity and immunity from the effects of vibration and oscillation stresses, such as are encountered when traveling over rough or uneven ground. At the front the frame narrows sharply to carry the pivot upon which the front cylinder is suspended centrally by means of a bridge connected to the axle on either side for steering purposes. By this means the machine is afforded a sharp turning angle, so that it can be turned in a short radius. The steering is effected by means of chains wrapping on a transverse spool geared from the steering column, which is of the ordinary automobile wheel steering type, the ends of the chains being attached to the side forks of the forward roller. The flooring is composed of stout steel plates.

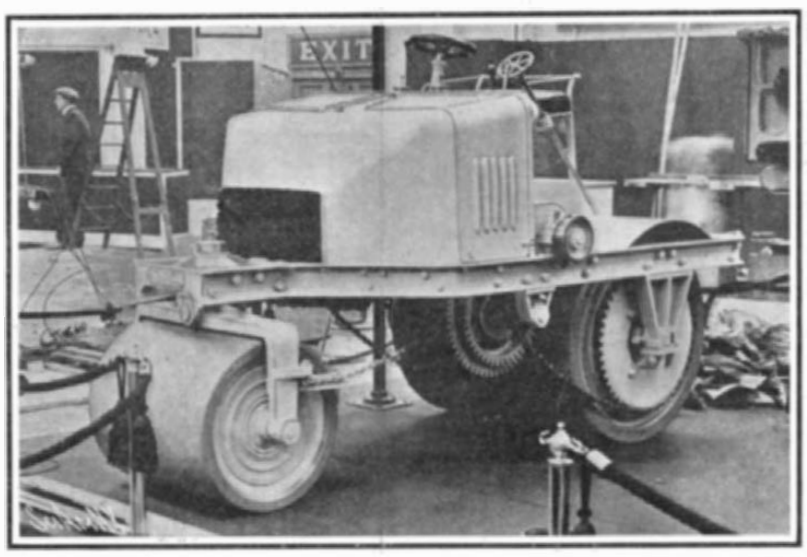
The gasoline motor is of the Fafnir water-cooled, vertical, twin-cylinder pattern, developing 8 horsepower. The engine is fitted with mechanically-operated inlet valves, and these for purposes of complete accessibility are placed in a convenient point on the tops of the cylinders. A divergence from usual practice in the case of vertical engines is adopted in placing the motor transversely in the engine frame, on the extreme right-hand side. On the opposite side of the frame are placed the gasoline and water tanks, the orifices for filling which project from the side of the bonnet, so that the latter need not be disturbed for replenishing the water and fuel supplies. High-tension electric ignition, with accumulator and coil, is fitted, the wipe contact being so placed that it is readily accessible. The water cooling is carried out on the usual lines with centrifugal pump and radiators. The whole of the mechanism, including the gasoline and water tanks, is inclosed in a large bonnet which affords complete protection to the working parts.

The power is transmitted from the motor to the rear driving roller by means of a bevel wheel fitted to the engine shaft, and thence through shafting to the change-speed gear and finally by side roller chains. There are two forward and one reverse speed fitted, the former being of one and three miles per hour, respectively. The differential gearing is placed inside the rings which form the driven side of the gear. The sprockets on the rear roller are of the solid type and are bolted direct to the side walls of the cylinder. The axle of this rear roller is provided with square ends, while the bearings on which it rests have oblong apertures, which arrangement enables the driving roller chains to be easily adjusted by means of two side bolts and nuts on either side of the machine.

The driver's seat is placed on the right-hand side, over the driving roller, so that he can easily follow the track of the main roller and watch the line along which he last traveled.

The change-speed lever quadrant is placed on the left-hand side of the driver, transversely, while the ignition-control lever, throttle, and switch, are attached to the dash. The machine is fitted with one powerful brake controlled by a second wheel and oblique pillar similar to that for steering, set conveniently near the driver. This brake acts directly upon the surface of the rear roller and constitutes an efficient means of quickly bringing the machine to a stop. In the illustration may be seen a small pulley mounted on the chassis frame. This is a belt pulley fitted to the end of the gear shaft, and in direct connection with the engine.

With the gears placed in neutral position, the machine by the aid of this belt pulley may be employed for stationary purposes, such as the driving of a pump, or other auxiliary machinery. The complete weight of the roller is approximately 5,000 pounds, the weight being so distributed that about two-thirds of the weight is imposed upon the rear driving roller.



A GASOLINE-PROPELLED ROAD ROLLER.

SHOEING AN OX.

The animal is lifted in slings and all the feet (with the exception of that to be shod) are tied.

AN OX-SHOEING SHOP IN THE WOODS.

In some portions of the Pacific Northwest teams of oxen and bulls are still used for hauling out logs from the forest. To prevent the animals from slipping on the wet skid roads and in the swamps, they are sometimes shod. The bulls, however, are so difficult to shoe that it is necessary to tie them securely before the operation; otherwise they would kick over the farrier and do other damage in their efforts to release themselves. The accompanying photograph shows one of the novel blacksmith shops, which is designed for shoeing bulls in one of the Washington lumber camps. The animal is led into a framework of stout timber underneath a beam, to which is attached a sling of heavy canvas. This sling, which is fastened by chains to the beam, is placed around the bull, and the animal lifted a few inches from the ground by turning the beam and winding up the chains by which the sling is fastened. In short, the bull is lifted in the same manner as a hand windlass is turned on board a ship, iron bars being used to revolve the beam in its socket. The feet, with the exception of the one to be shod, are then tied to the framework of the "cradle," as it is called. Only in this way can the shoeing be safely done, and frequently two men are required, one to hold the foot while the other adjusts the shoe and drives the nails.

A New African Fly.

A new African fly, whose larva lives parasitically upon the skin of rats, is described by W. Dönitz under the scientific name *Cordylobia murium*, in the Berlin Sitzungsberichte der Naturforschenden Freunde. Robert Koch in his explorations in East Africa heard in Morogoro of sickness, suspected of being plague, among the rats in the Roobeno Mountains. After an eight days' march he found on the spot that the mortality among the rats was not caused by plague bacilli, but by parasitic fly-maggots living upon the skin. From these maggots Koch bred flies, which W. Dönitz is now scientifically studying. The chrysalis stage of the fly reared by Koch lasted almost exactly a month. Nothing is known of its life in freedom; but from the conditions under which it was found upon the rats, an idea may be formed how it lays its eggs. The swellings or boils caused by the larvæ are always found only on such places upon the body of the rats as touch the ground, on the under-side of the legs and on the belly. From this we may at once conclude that the fly does not first lay its eggs in the fur of the rats, but deposits them upon the earth, perhaps in the rat-holes themselves, where the larvæ hatching out can certainly come in contact with a rat and crawl upon it. Should the fly be in this way specially suited to the rat, then it will not be particularly dangerous to men. Yet parasitic fly-maggots have repeatedly been found in Africa in boils of men and many mammals, and been described by Blanchard and Grünberg as another species of the same genus, *Cordylobia anthropophaga*. This fly is often found in Guinea upon the people employed in railroad building, and by their dogs has been spread far into the interior. French savants observed that from one and the same dog daily for weeks five to six specimens of this larva (called *ver du cayor*) were taken. The dogs thus substantially contribute to the spread of the fly. He who in such a region in Guinea stretches himself out, between April and October, for a rest upon the earth must expect that such a fly larva will crawl upon him. At the beginning of the drought in October the fly disappears, and is first seen again in March. In what manner the species is maintained during the interval is not known.

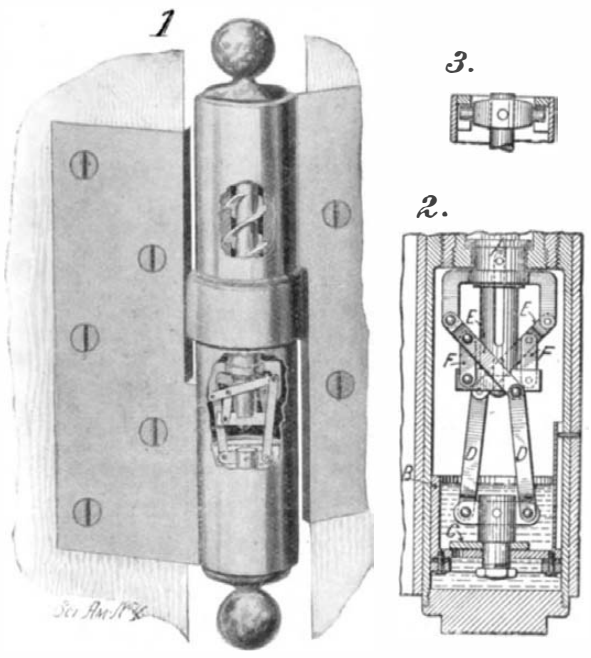
The Area of the United States.

The United States Geological Survey has just issued Bulletin 302, by Henry Gannett, which represents the result of conference and co-operation of the Land Office, Census Bureau, and Geological Survey in an effort to agree on what constitutes "the area of the United States." The absence of a standard of measurement for determining the area led to a discrepancy between the tables of the Census Bureau made in 1887 and those of the General Land Office prepared in 1899. The result of the co-operation of the departments is that the area of the United States proper, which is given as 3,026,789 square miles, has been increased over the census figures by 1,188 square miles. The bulletin gives the area of Alaska as 590,884; the Philippines, 115,026; Hawaii, 6,449; Porto Rico, 3,435; Guam, 210; Samoa, 77, and the Panama Canal strip, 474 square miles.

All of the detached territory is subject to change as the limits become more correctly defined.

NOVEL DOOR HINGE AND CHECK.

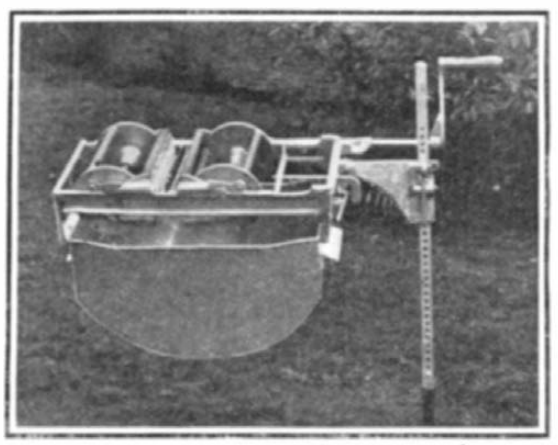
Pictured in the accompanying engraving is a hinge of self-closing type, which is provided with a check that prevents shock of impact of the door on the jamb of the casing. The hinge is particularly adapted for service on large, heavy doors. It comprises two leaves, that at the left in the engraving being secured to the casement of the doorway. This leaf is formed with a cylindrical barrel, which is shown in section in Fig. 2. Secured in the barrel is a chamber for oil or the like, used in cushioning the swing of the door. Fitted into this chamber is a cup-shaped piston *B*. The piston is adapted to slide vertically within the chamber, but a pin therein engages a slot in the piston, preventing the latter from rotating. In the bottom of this piston is an arcuate port, normally closed by a flat gate valve *C*. The latter is mounted on a short shaft, which is free to revolve in said piston, and also has slight vertical movement therein, which is limited by a nut, as illustrated. A crosshead on this shaft is connected, by means of a lazy tongs construction, consisting of links *D* and *E*, to a yoke piece *A*, mounted in the upper part of the chamber. Depending from the links *E* is a pair of links *F*, which support a crosshead on the pintle rod of the hinge. This rod, which passes through the yoke *A*, has a pin-and-slot connection therewith, so that the two members rotate together, but the rod has independent vertical movement therein. The upper portion of the rod is formed with a broad thread, which engages a nut block secured to and extending above the oil chamber. Fitted over this nut block and the upper end of the oil chamber is a barrel, which is formed on the second leaf of the hinge, that is, the one secured to the door. This barrel engages the trunnions of a crosshead pivoted to the top of the pintle rod, as shown in Fig. 3. In operation, when the door is swung open to the position shown in Fig. 1, the pintle rod is rotated, due to its connection with the upper barrel of the hinge, and it is thereby fed upward in the nut, lifting the door bodily. But when the rod is lifted, the lazy tongs acts first to raise the valve off its seat, and then to draw the piston *D* upward, while the oil above the piston flows through the open port. At the same time the valve turns with the pintle rod to open position. When the door is closed, the valve is first seated and then the piston is pushed downward, while the valve gradually closes the port. The oil pouring up through this constantly narrowing port serves to cushion the swing of the door. The thread on the pintle rod is double, and of such a pitch that the weight of the door can be utilized in place of a spring to swing the door to closed position. A patent on this improved hinge has recently been secured by Mr. C. E. Treadwell, 1857 California Street, Denver, Col.



NOVEL DOOR HINGE AND CHECK.

AN IMPROVED MILKING MACHINE.

A milking machine has recently been invented which aims to reproduce accurately, by mechanical means, the action of the hands when milking. Not only does the machine facilitate the operation of milking, but it insures a clean supply of milk, as the hands need not touch the teats. The device is portable, being adjustably mounted upon a light standard, which can be moved to any desired spot. The accompanying engraving clearly illustrates the form of the machine. It comprises a receptacle or pail, above which is the mechanism for drawing the milk. The operation of this mechanism will be best understood by reference to the diagram. The teats are engaged by a series of rollers which press them against a pair of "compression plates." When adjusting the mechanism to a cow, the device is moved up until these plates bear against the udder at the center with the teats outside of them. There are two sets of rollers, one for each of the plates. The rollers of each set are journaled between a pair of disks keyed to a shaft. The shafts are connected by suitable gearing to a crank handle. By turning this handle the rollers are carried along in the direction of the arrows, flattening the teats against the plates, and producing a downward rolling pressure, which causes the milk to flow into the pail. The rollers and plates are covered with rubber, and the plates are backed with safety springs, which prevent injury to the teats. The space between the rollers and the plates can be quickly adjusted for large or small teats. The machine contains no pipes, but all parts are accessible, and can be readily cleaned, so that there is no danger of tainting or contaminating the milk. The working parts are made of aluminium and, consequently, the machine is very light.



A NEW MECHANICAL MILKER.

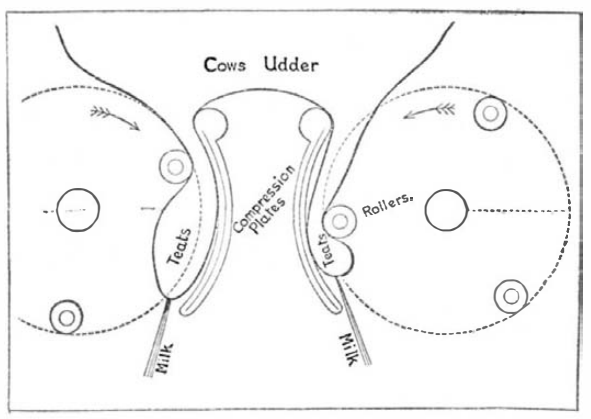


DIAGRAM SHOWING OPERATION OF THE MILKING MACHINE.

Fastest Long-Distance Run on Record.

The discussion of the fast times made by automobiles in the recent race on Long Island has served to bring out in our contemporary, the Railway Age, an official statement which makes a valuable addition to the record of fast running on steam railroads. It will be remembered that the winner of the Vanderbilt cup contest covered 297.1 miles at an average speed of 61.43 miles an hour, and that the fastest round was made at an average speed of 67.6 miles an hour. The interest aroused by the discussion of these records has led the Assistant General Manager of the Lake Shore and Michigan Southern Railway to send to our contemporary a letter giving the details of a fast long-distance run which was made over the lines of that company June 13, 1905. The writer, Mr. D. C. Moon, states that at that time as Assistant General Superintendent he had charge of the arrangements for the run and rode on the train. No special arrangements in advance were made for this run, which was only determined upon the evening preceding the day on which it took place. The train consisted of a coach and two private cars. It left La Salle station, Chicago, at 6:50 in the morning, central time, arriving at Buffalo Exchange Street depot at 2:23 P. M., central time, having covered a total distance of 525 miles in 453 minutes. The total time to be deducted for stops (time during which the train was actually standing still) was 9 minutes, which was consumed in changing engines at Elkhart, Toledo, Cleveland, and Dunkirk. The through rate of speed, including the stops and slowdowns from terminal to terminal, was 69.53 miles an hour for 525 miles. Deducting the 9 minutes allowed for stops, the average rate of speed was 70.94 miles per hour. The fastest mile made on this run was 40 seconds, which was equivalent to a speed of 90 miles per hour.

The fastest speed made for that distance was recorded just ten years before, during the celebrated railroad racing from London to Aberdeen over routes of approximately equal length. Over the West Coast route 540 miles were covered in 8 hours 32 minutes, at an average speed of 63.24 miles an hour while running. Over the East Coast route 523 miles were covered at an average speed while running of 60.20 miles an hour. As a mere question of distance run at a certain speed irrespective of grades and curvature, the Lake Shore and Michigan Southern run is considerably the fastest on record. When we take into consideration the gradients and other track conditions, which were much more severe on the English roads, particularly among the hills of Scotland, the disparity between these two performances is greatly modified, the greater part of the Lake Shore run being made over a straight and level road laid across the prairies.

Recently Observed Meteors.

The officers of the freight steamer "St. Andrew" report that on the afternoon of October 31, about sixty miles northeast of Cape Race, Newfoundland, they saw three meteorites plowing through the air from zenith to horizon. Despite the fact that it was broad daylight, the meteorites seem to have been most brilliant. The accounts which are given of the size of the meteorites vary so much that very little reliance can be placed upon them. The largest of the meteors dropped into the water about a mile from the vessel, and is said to have caused the water to boil for a considerable area. The Hamburg-American liner "Brazilia" also observed a meteor northeast of Cape Race on the night of the same day. The "Brazilia's" meteor was visible for thirty seconds before it buried itself in the sea.

A Big Paper-Making Machine.

There has just been completed by a firm of Edinburgh, Scotland, the largest paper-making machine ever constructed. Some idea of its dimensions may be afforded by the statement that a shed 185 feet long is not sufficient to house it. The striking feature of the machine is its great width. This is called for by the fact that the paper mill company in Sweden to whose order it has been built, intends to use it for the making of two sheets of newspaper, each 75 inches wide, or 150 inches of finished paper. To run a sheet of this width at the high speed of 500 feet per minute requires a machine with exceptional driving gear and rolls of extraordinary diameter and weight. The paper to be made is to have a better finish than is customary for newspaper use, and to that end an enormous stack of calender rolls is provided. These rolls weigh about 70 tons, the bottom one alone weighing 14½ tons. The steam engine by which the machine is to be driven is capable of developing 200 horse-power. With all accessories the complete machine weighs 550 tons, and a special steamer has been chartered to carry it to Sweden. The price paid for the big machine by the Swedish company was $72,997.

A party of tourists who found themselves quite a few miles from nowhere with a tube well beyond repair and nothing to take its place hit upon an expedient, which if not one deserving to be highly recommended to others who find themselves in a similar predicament, at least served its purpose of avoiding a badly rim-cut shoe as well as a bent rim. With a tube that was little more than scrap rubber and no spare at hand, it was either a question of driving on the rim or not at all. The road was rough and uneven, with more or less rock, so that even a few miles would mean the end of the rim. It was down in southern New Jersey, where sand and pine trees abound, and the shoe was carefully packed full of the former material all the way round and carefully replaced on the rim, so as to permit none of it to escape. As a substitute for compressed air it had the disadvantages of bulk, weight, and stiffness, but it served the end desired by preventing the shoe from flattening and rim-cutting and the rim itself from being ruined.—Motor World.

THE MILKING MACHINE IN USE.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SEPARABLE FASTENER.—G. E. WRIGHT, New York, N. Y. The principal object of the improvement is to provide a substitute for the various forms of hooks and eyes now employed on garments and the like and so construct it as to provide for a more easy hooking and unhooking of the device; and also to simplify the construction and prevent the displacement of the two parts of the fastener accidentally.

Electrical Devices.

ELECTRIC-LIGHT-BATH CABINET.—H. H. ROBERTS, Lexington, Ky. In this case the invention is in the nature of a novel cabinet, designed to treat the body with the radiant heat and light of electric lamps under variations of different colors of light and the special application of high-frequency currents.

Of Interest to Farmers.

HAY-STACKER.—J. C. HARRIS, Greeley, Neb. In the operation of this stacker the fork-frame being in position such that the horizontal teeth are on the ground a shock of hay is drawn thereon. Power is then applied to the ends of the hoisting-ropes which elevates the frame, and hay. At first the frame travels half as fast as the ends of the rope. When the frame contracts with the sheave-arms, the pull is direct, this giving a quick jerk of the frame, whereby to throw the load upon the stack.

Of General Interest.

TELESCOPE-MOUNTING FOR GUNS.—J. WILKINSON, Bridgeport, Conn. In the present patent the invention is a telescopic mounting for guns, the telescope being pivotally attached to a gun by links, and thus adapted to be temporarily elevated to obtain a clear view of the open sights below it when the telescope is not used.

DRUM.—P. BERLINGHOFF, New York, N. Y. The drum is of the kind used in bands, orchestras, or the like, the inventor's object being to provide a drum so constructed that it may be compactly folded or reduced in length for convenience in transportation or storage and that when extended will be held rigidly in normal or playing position.

TRY-SQUARE.—J. COLLIE and C. BEAUCHENE, Lake Linden, Mich. The invention relates to try-squares such as used by mechanics and particularly by carpenters in laying out work. The object is to produce a square which will be provided with means enabling two faces of the work to be marked simultaneously. It enables a timber to be marked for a square or plumb cut and also a beveled cut.

TRUSS.—F. CRATER, Parsons, Kan. The principal object of the truss is to provide means for equalizing the strain. In this invention a person on assuming a stooping position automatically increases the pad-pressure by the shortening of the belt, thus guarding against displacement. The self-adjustment of the elements of the improvement greatly adds to the comfort of the user. The necessity of an elastic belt is obviated.

TRACE-BUCKLE.—H. JOHNSON, Edgerton, Mo. The object of the invention is the production of an attachment for a trace-buckle which shall permit the ready fastening, release, or adjustment of straps and bands, and particularly of heavy articles of this nature, such as traces or tugs of harness and one which shall form an additional fastening to the single-tongued buckle in common use.

FOUNTAIN-PEN.—J. J. MEAD, New York, N. Y. Mr. Mead's purpose is to provide a pen of that type which contains a sack as a receiver and container of the writing fluid, so constructed that it will be simple and economic and so that the parts will be few in number and may be assembled and secured in position in a rapid, convenient, and durable manner.

COLORING-MATTER FOR PRODUCING SILK-LIKE OR PEARL-LUSTER EFFECTS.—L. LILIENFELD, Vienna, Austria. The object in this instance is to provide a new and improved coloring-matter for printing, painting, coating, or otherwise treating articles made of wood, metal, paper, leather, textile fabrics, etc., to produce a silky or pearl-luster effect.

SMELTING-FURNACE.—F. L. MCGAHAN, St. Louis, Mo. One purpose of the inventor is to provide a furnace in which the heated products of combustion and unconsumed gases are withdrawn from the furnace and after being passed through a carbureter to enrich them are again returned to the furnace, so that not only is the heat utilized, but also any unconsumed gases are consumed in their second passage through the furnace.

POLLEN-COLLECTING DEVICE.—E. MOULIÉ, Jacksonville, Fla. By means of this device pollen is collected for use in the manufacture of medicines and the like, and is particularly useful in connection with devices of this character in which severed twigs or branches bearing blossoms from which the pollen is to be collected are held with their stems immersed in water or other liquid contained in a vessel.

FOLDING CARPENTER'S SQUARE.—J. TREGELLAS, Goldfield, Nev. The invention is a carpenter's square whose members, arranged in use at right angles to each other, are pivoted together, and thus adapted to be folded one alongside the other, whereby it occupies small space and is adapted to be more conveniently carried, stored, or packed.

Heating and Lighting.

CIRCULATION DEVICE FOR HOT-WATER HEATING PLANTS.—H. V. JÖRGENSEN and C. H. SÖRENSEN, Arrhus, Lille Tory 2, Denmark. Hot water heating plants in which air is blown into a main rising-pipe in order to increase the circulation of water in the pipe system are well known. The object of the existing patents in this line is to produce a circulation as powerful as possible in proportion to energy expanded and in such manner that the system does not lose heat and so that the use of air does not cause special difficulty.

BOILER.—F. S. GULICK, Pittsburg, Pa. The improvement pertains to boilers, and more particularly to those adapted for domestic use and in which the source of heat consists of burners to which a combustible fluid is supplied. Water is quickly heated with comparatively little fuel. The thick heavy bottom of the boiler not only serves to assist in heating the water but also in keeping it hot.

GRATE.—R. V. BRAWLEY, Statesville, N. C. This invention is an improvement especially in grates designed for use in open fireplaces. When desired the entire grate may be readily lifted from the front frame of the fireplace so that in summer or other times when a fire is not desired in the grate the entire fireplace may be open and unobstructed.

LANTERN.—A. ROSENBERG, 259 High Holborn, London, England. This invention refers to improvements in optical signaling and searchlight operations, and is especially designed for use in connection with the signaling apparatus for which application for Letters Patent, of which this is a division, was formerly made by Mr. Rosenberg. Besides oil or gas, other sources of illumination may be used with the lantern—as, for example, the so-called "oxyhydrogen" combustion of lime-light apparatus or electric light apparatus.

Household Utilities.

HANGER FOR SHADES.—J. K. PUTNAM, Montpelier, Ind. The object of the invention is to provide a hanger which may be readily attached in position and which will operate as an efficient guide for the supporting-cord passing therethrough and afford means at the same time for locking the cord quickly, so as to support the shade at any desired height.

DUST-PAN.—W. N. STEELE, New York, N. Y. The aim of the inventor is to provide a pan arranged to permit convenient sweeping of the dust, crumbs, and the like into the pan, to securely retain the sweepings, and to allow ready dumping of the accumulated sweepings whenever it is desired to do so and without danger of spilling any of the sweepings while carrying the pan and contents from the room to a place of discharge.

Machines and Mechanical Devices.

VALVE.—J. J. WILBER, Perth Amboy, N. J. In this case the invention relates particularly to combined gate and check valves, the object being to provide a valve mechanism that may be readily reversed, depending upon the direction of the flow of liquid through the pipes and also constructed so that it may be easily repaired.

WIRE-STRETCHER.—W. ELLIS, Penfield, Ill. The stretcher is particularly designed and adapted for stretching woven-wire fence fabric, and there are novel means for supporting the device in convenient and effective position for applying the power necessary to operate the same and for clamping and straining all of the line-wires of the fence simultaneously.

HYDRAULIC ELEVATOR.—W. L. LELAND, San Francisco, Cal. Water passing up through the nozzle creates a suction in the annular chamber, drawing air therethrough and carrying it upward with it. The cylindrical ring opening is greater than that of the nozzle, the force of water tending to form around itself a coating of air drawn in from the chamber. In placing the elevator in the pit the casting may be placed for receiving the supply-pipe, and the elbow may be turned with reference to casting to bring it into better position for connection with the pipe. If the jacket opening be not properly placed with respect to material to be excavated and removed it may be rotated with respect to the casting to bring the opening into proper position.

Railways and Their Accessories.

RAIL-JOINT.—E. A. GILLCHRIST, McKeesport, Pa. One purpose of the invention is to provide a special rail-joint, primarily intended for use upon steam and electric railways, but which can be used in structural work when conditions will permit, and to so construct the joint that it can be used in connection with any form of rail and in any form of fish-plates adapted to the rail.

CAR-STAKE.—A. W. BAGLEY, Tacoma, Wash. The invention is particularly useful in connection with cars adapted for the transportation of logs, lumber, and the like. The objects are to provide a stake which rigidly holds in position the load upon a flat or other car; and a stake which may be released from an upright position by means of a catch operated from a side of the car opposite to that upon which the stake is pivoted.

Railways and Their Accessories.

CAR-COUPLING.—W. KELSO, Pittsburg, Pa. This coupling enables the trainman, without exposing himself to danger, to control easily the connecting and disconnecting of cars. It has a swinging knuckle which is released by merely lifting a sliding member, and when this member is lowered the coupling is left in such condition that the knuckle becomes locked as soon as the cars bump together.

AIR-BRAKE APPLIANCE.—H. C. LUCK, Telluride, Col. The object of the present invention is to provide a brake appliance designed to automatically set the brakes in the train in case any one of the cars in the train moves out of normal position either by derailment or on account of a broken axle, broken arch-bars, or other causes. It relates to such as shown and described in Letters Patent of the United States formerly granted to Mr. Luck.

AUTOMATIC SAFETY RAILWAY-SWITCH.—J. W. HUBBARD, Eau Claire, Wis. The object of the inventor is to produce simple mechanism for operating a switch automatically and to provide such arrangement as will enable the same switch to be operated manually, if desired. The invention includes also means for locking the switch in its open or closed position and provides a releasing device enabling the switch to be operated either manually or automatically.

Pertaining to Recreation.

TOY MARINE VESSEL.—B. C. DEAN, Keene, N. H. The object of the invention is to provide a toy made in sections adapted to be readily assembled and secured in place by children, thereby serving instruction for children, at the same time producing a vessel, such as a toy or miniature yacht, capable of sailing on the water.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 8465.—Wanted, wholesale dealers in brass gas tubes, to manufacture into air gas barrels, having following requirements: free from kinks, cut 20 inches length, small enough to dress smooth when bored to 14-100 of an inch.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8466.—Wanted parties to equip a wood alcohol plant.

Headquarters for new and slightly used machinery. Liberty Machinery Mart, 138 Liberty Street, New York.

Inquiry No. 8467.—Wanted, apparatus for reducing the volume of liquids by evaporation under vacuum. also for sealing jars by atmospheric pressure.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St. N. Y. C.

Inquiry No. 8468.—Wanted. machinery for making popcorn, bricks, etc., also candy-making machines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8469.—Wanted, makers of slot machines for vending drinking water, other than the Automatic Penny-Drink Machine Co., of New York.

Inquiry No. 8470.—Wanted, a second-hand electric motor, alternating single-phase, 4 or 5 h. p.

Inquiry No. 8471.—Wanted, a machine for extracting the fiber from salt codfish.

Inquiry No. 8472.—Wanted, makers of corn pith cellulose.

Inquiry No. 8473.—Wanted, the name and address of the dealers in pumice stone, made in Germany by Schumacher.

Inquiry No. 8474.—Wanted, manufacturers of alcohol distilling machines.

Inquiry No. 8475.—Wanted, a rock crusher, to be operated with a 2 h. p. gasoline engine.

Inquiry No. 8476.—Wanted a practical burner using alcohol as fuel, for use under the boiler of Locomobile steam carriage.

Inquiry No. 8477.—Wanted, the name and address of manufacturers of electric fountains for parks.

Inquiry No. 8478.—Wanted, a plant for making lath for building; also a planing mill for dressing rough lumber; also machinery for making shingles and staves.

Inquiry No. 8479.—Wanted, makers of gasoline motors of 15 to 25 h. p., weight about 3 pounds per h. p

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10203) G. S. M. asks: Will you kindly let me know through the columns of your paper whether it is necessary for the temperature of the air to become 32 deg. F. or lower in order to produce a "white frost"? If not, please give reasons. A. It is necessary for the air to be at 32 deg. at the point where the white frost forms. It is not necessary for it to be at 32 deg. any disfance above that point, even one foot above. The air is a non-conductor of heat, and may be several degrees warmer at a very little distance from the place where frost is forming. Vegetation and stones are better conductors of heat than is air, and hence become cooler than the air. Hence the dew is deposited on these, and the dew freezes to ice crystals, which is frost.

(10204) C. E. D. writes: To yours of the 2d it is quite evident you have not tried it. Please keep in mind that the ice is chipped; that the only time when this experiment has been tried is in the hot weather, when chipped ice will not stay dry. Also remember that the fruit juice and sugar mixed with the ice forms a freezing mixture. A hot spoon is, therefore, not needed for the purpose of melting the ice. A cold spoon has plenty of liquid around it. The ice ought to be just as cold and just as liable to attach to the cold spoon as to the hot one, in fact more so, but it does not do it. The question is, "Why?" Your answer is, therefore, incorrect and I am still in the dark. The spoon does freeze to the ice in the liquid. I have never tried it with the ice free from liquid. Kindly try the experiment and then I will be pleased to have your further opinion. I assure you it has been a puzzle to me. A. We have delayed reply to your last letter in order to make some tests regarding the matter of the spoon in sugar and ice. We took your statements in your first letter and gave what seemed a reasonable explanation for them, which you reject with rather more assurance than we think the case required, since you confess you do not understand it. We have made our tests and can now speak with personal knowledge. We used a thermometer as a testing instrument and not a silver spoon, as you appear to have done. We find that the heat necessary to melt sugar in ice will reduce the temperature of the ice to about 9 deg. F. below the freezing point of water. We do not think we are justified for this reason in calling, as you do, a mixture of syrup, sugar, and ice a "freezing mixture." Scientists do not consider this a freezing mixture. The presence of the syrup prevents the temperature from going as low as it will with the sugar alone. This should be so, since the sugar in the syrup is already melted and does not take heat from the ice with which to melt. All solution is accomplished by heat, and heat disappears in dissolving anything in water or melting it with ice when the material melts in ice as sugar will do. When there is no chemical action involved the temperature in the act of solution always falls; when chemical action accompanies solution there may be so much heat evolved by the chemical action as to overbalance the heat absorbed in the act of solution. Now as to the attachment of pieces of ice to the spoon. There is no mystery in this. We, however, dissent from your statement that a hot spoon is necessary, since we froze the ice to the cold spoon without any difficulty. The case is simply that of a slight film of water between the cold spoon and a piece of ice. The silver of the spoon is the very best conductor of heat, and so the spoon can easily melt a film of water if the ice is dry or become cooled to the temperature of the sugar and ice, 23 deg. F. about, and then the freezing of pieces of ice to the spoon is the matter of a few moments. You might hold ice in your fingers and freeze it to a spoon if you will keep the spoon below 32 deg. F. Tyndall froze pieces of ice together under hot water by the same principle, that of regelation. You may have frozen your (hot) fingers to a piece of cold iron on a cold day in winter. The horse's bits will freeze to his mouth in the same way unless they are warmed in winter. The two actions are quite similar. You may accept it for a certainty that ice cannot freeze to a hot spoon until it has first reduced the temperature of the spoon to 32 deg. F. or lower. It is absurd to claim it.

(10205) H. B. asks: Would you please tell me if the ½-inch Ruhmkorff coil used with the set of wireless telegraph mentioned in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1363, page 21849, of February 15, 1902, could be made to work the receiving apparatus explained in the same issue to a distance of 1-3 of a mile over land? If not, how large a coil will it require? A. We suppose the ½-inch coil *could* be made to work a wireless receiver at a distance of 1-3 mile over land, else Mr. Hopkins would not have said it could; but we should use a 2-inch coil, or larger, if we were going to put in a set of instruments to have them available under all conditions, or a coil giving even a larger spark than that. A large coil will give a fat, short spark. Any coil near its limit of spark length must give only a thin, blue spark.

(10206) G. B. asks: We have tried different ways in cutting round glass rods of ½ inch to ⅞ inch without good results. Will you kindly advise best way of doing same? A. A glass rod is usually broken by making a cut on one side with a file or diamond and giving a quick bend at the point opposite to the cut. An improvement upon this method, although requiring more work, would be to make a cut entirely around the rod, and apply heat at the place where the cut is made. A red-hot piece of iron ⅜ inch in diameter will be the best for applying the heat to the rod. This may be fitted into a handle and used as a soldering tool is used in the hand.

(10207) W. J. T. writes: I learn through a manufacturer of great numbers of automobile Ruhmkorff coils that by placing the inside terminal of the secondary winding nearest the vibrator a somewhat longer spark may be obtained than when the outside terminal is placed nearest to it. Judging from some coils which I have personally examined (and made by other manufacturers), small Ruhmkorff coils are in general constructed like those of the above manufacturer. Has any reason ever been given as to why the placing of the inner terminal of the secondary nearest the vibrator increases the spark length of the coil? I have found by personal experiments on several small coils that a much longer spark may be picked from the outside than from the inside terminal of the secondary when the knuckle or a conductor is presented thereto. Can you enlighten me on this phenomenon? A. We should consider that more careful experiments would be required than you describe before a generalization could be made that a longer spark can be obtained from one end of a coil of wire than from the other end. It may be so, but data as to voltage, amperes, and mode of producing the spark should be taken. We have no theory to advance, nor do we question in any way the facts as stated.

(10208) J. P. A. asks: Comparing the chemical equivalents (atomic weights) given in Century Dictionary with those stated in text books on this subject, I find considerable difference in the figures. In some cases, the amounts are one-half for those of text books as against the amounts of Century Dictionary, while in other cases the differences of amounts are without definite proportion. If the determination of equivalents of elementary bodies has passed beyond the presumptive state, will you kindly advise me where the truth of this matter may be found? A. We should no more think of going to the Century Dictionary for the chemical equivalents, or atomic weights of elements, than we should think of going to an almanac seventeen years old. The Century Dictionary is most valuable in its field; but surely its field is not to give data which have been made far more correct since its publication seventeen years ago. The American Chemical Society has a committee upon atomic weights, and its figures reported from time to time are received as authority. Probably the most weighty name in connection with this work is that of Prof. F. W. Clarke, the chief chemist for many years of the United States Geological Survey. The determination of atomic weights has passed beyond the "presumptive stage," and the results may be found in any recent chemistry, such as Remsen's "College Chemistry."

(10209) J. E. A. asks: The article describing the dry generation of acetylene in SUPPLEMENT No. 1607. I would like a little information if you can give it to me. The article in question says: "Mix carbide with soda." I have been trying to generate acetylene as described, but with indifferent success. If you can tell me what kind of soda was used, you will oblige me very much. A. It is probable that carbonate of soda is intended in the article upon the dry generation of acetylene, although there would seem to be no objection to using sulphate of soda for the purpose other than that carbonate is cheaper than the sulphate of soda. The smaller sizes of carbide should be used and the sodium carbonate should be crushed so as to render contact between the two more easy. The carbonate of soda has ten parts of water of crystallization, so that in 286 pounds of carbonate of soda crystals there are 180 pounds of water. This water it is which produces the acetylene just as in the ordinary methods of generating acetylene and when the action is over the carbonate of soda is present in the receiver deprived of its water. There will be dry calcium oxide and dry carbonate of soda. From a chemical point of view there seems to be no advantage in using the soda instead of water, since soda costs much more than water. Nor is it apparent that the acetylene generated in this way would be different from that generated by water.

(10210) D. C. D. asks: In order to settle a friendly dispute, will you answer in "Notes and Queries" the following question: Does the moon revolve on its axis? A. The moon rotates on its axis once while it revolves around the earth once. For this reason it presents always the same face to the earth. The face of the moon shows always the same physical markings. If it is not apparent to any one that the moon must rotate upon its axis in order to keep the same face toward the earth, let him take anything round, for example an apple or a ball, and make a plain mark on one side of it. Place a lamp in the middle of a room and hold the ball representing the moon with the mark toward the lamp. Notice which wall of the room the marked side of the ball faces. Now walk a quarter of the way around the lamp, having the lamp on the left hand as you go, and keeping the mark on the ball directed toward the lamp. To do this you will find that you must turn the ball around one-quarter of a turn toward the left, or in the opposite direction to that of the motion of the hands of a clock. Continue this till you have gone quite around the lamp. You will have turned the ball through an entire rotation on its axis, thus imitating the actual rotation of the moon on its axis as it revolves around the earth. You will find this matter fully explained in Todd's "New Astronomy," page 242. We can send you this book for $1.50.

(10211) M. H. asks: A friend of mine makes carbonic acid gas for his aerated waters from bicarbonate of soda and sulphuric acid and the residue left in the gas generator is thrown away daily. I should feel obliged if you would kindly inform me to what profitable use this residue can be put. A. The reaction of sulphuric acid and bicarbonate of soda gives carbon dioxide (carbonic acid) and sulphate of soda, when the ingredients are in proper quantities. The sulphate of soda has little value. We should not advise the use of bicarbonate of soda for this purpose. It is too expensive. Pieces of marble and hydrochloric acid, or sulphuric acid ether, will give the carbon dioxide just as well. The marble chips will cost little or nothing. If sulphuric acid is used calcium sulphate is formed, which is not soluble in water and settles to the bottom. If hydrochloric acid is used calcium chloride is formed, which is soluble in water and leaves little or no sediment.

(10212) H. E. says: Will you please inform me if ice formed from sea water becomes pure or nearly so, how about the ice in the Arctic Ocean? It is all salt. A thin layer of snow on the top of the ice becomes salt. If we want snow to melt to relieve our thirst we must take it off the top of a drift a little above the surface of the ice. A. In saying that ice from sea water is fresh, it is not intended to say that no salt will be on the outside of such ice. Ice frozen from sea water is also very likely to have salt in the mass of the ice in very cold regions where the ice forms rapidly. We quote from Whetham's "Recent Developments of Science," page 80: "If we cool a solution of common salt the ice which freezes out is the solid form of pure water. If the ice be frozen rapidly, some trace of salt may be deposited also; but experiment has shown that it does not enter into the composition of the crystals, and is entangled merely mechanically in their interstices." If a dilute solution of a colored material such as potassium permanganate be taken, and partly frozen, the ice will be clear, and the remaining liquid will be more strongly colored. We are sure every farmer knows that if a barrel of cider freezes the ice forms on the outside of the barrel and is water ice, but the liquid left in the middle of the barrel is very much stronger than the cider was at first. Of course ice in sea water gets salt on its surface very quickly, and so does snow over sea ice.

(10213) A. M. asks: Please let me know what I would need to cause the sound of a clock to be transmitted a distance of, say, 150 feet by electricity. A. A simple device would consist of a telephone transmitter in front of the clock and a receiver at the point at which you would hear the ticking.

(10214) B. F. V. writes: Will it affect the quantity of gas consumed in a building whether the gas is turned on full at the meter and partly turned off at the burners, or partly turned off at the meter and fully turned on at the burners? Assuming the same number of jets burning and the same illuminating power in both cases. A. There is a very slight difference in the volume of gas due to the pressure at the meter and the proper pressure at the burner jet, which indicates a saving of gas by the meter measurement at the higher pressure or by regulating the pressure at the burners instead of at the meter.

(10215) J. W. D. asks: 1. How long does it take to decompose one pound acidified water with a current of 100 volts? A. The time required to decompose a pound of water depends upon the amount of electricity used. If 13½ amperes are used at 100 volts it will require one hour. From this the time for any other current can be found, or the current for any other time. Water is decomposed with any voltage greater than 1.47 volts. You will see then that 100 volts is very much higher than is necessary. 2. How much does it cost to run a dynamo of 1,000 volts annually, including all expenses? A. That depends upon how many amperes the dynamo is to furnish. A dynamo giving 1,000 volts might be lighting a small village, or it might be lighting a large section of your city. The cost would not be the same in both cases.

(10216) G. G. S. asks: Please inform me as to the amount of current used by (1) ½-inch solid carbons, (2) ½-inch soft core carbons, (3) ⅝-inch solid carbons, (4) ⅝-inch soft core carbons, when used in a stereopticon on 110-volt alternating current circuit. A. Stereopticons are usually run with ½-inch carbons. We have never used one with a larger carbon. The ½-inch carbon will carry as high as 25 amperes, but 10 to 15 amperes is the usual current for such a lamp. A ⅝-inch carbon would carry 25-16ths as much current as a ½-inch carbon. The current would be proportional to the area of cross section of the carbon.

(10217) J. V. J. asks: 1. Why are open circuit telegraphs not used as often as closed circuits? A. The calling apparatus requires a closed circuit. 2. Can the duplex be worked on them? A. We do not know as to the possibility. Many things are possible which are not practicable. 3. Does an arc lamp when placed under water decompose? A. No. It heats the water. 4. Can a person get a shock from one carbon-zinc cell? A. Not from the battery alone. 5. Can an electric motor be driven both ways to advantage? A. Yes. Street car motors are reversed very often.

(10218) W. writes: A boiler which has a 2-inch feed pipe and 2-inch check valve reduced to 1½-inch discharge, the size the pump calls for. A 2-inch pipe extends from boiler 4 feet to check valve, and also 2-inch pipe continues from check about 4 feet, when it is reduced to 1½ inches. A claims that there is one-quarter greater resistance on the pump than should be or would be if there was 1½ inch check valve. B claims it has nothing to do with it, but that if even the check valve was larger it would not affect the pump. Who is right? A. B is correct. The larger size of the check valve makes no more work for the pump. If anything, it favors the work of the pump, causing less friction and resistance.

(10219) M. C. A. asks: Will you please inform me what size and how many feet of wire it will take to make an electric heater, 104 volts, say 5 to 7 amperes capacity? A. Seven amperes at 104 volts require 15 ohms of resistance. For a rise of 190 degrees F. the resistance rises 40 per cent. Hence about 5-7 as much wire will be needed if you wish to raise the temperature about to that of boiling water. No. 14 iron wire may be used. This has about 65 feet to an ohm. These are approximate numbers, and you can adjust the quantity to the temperature you wish to maintain.

(10220) J. M. C. asks: 1. Are there transformers made for direct currents? A. Yes. They are called rotary transformers, or converters. 2. Are 500-volt arc lamps made and operated successfully? A. No open arc light uses over 50 volts. It cannot. Inclosed arc lights use about 80 volts. Upon circuits of higher voltage as many arc lamps are put in series as will use up the voltage. On 500 volts ten arc lamps will burn in series. 3. Is there a chemical preparation or the like by which I may be able to clean fiber of oil? A. We do not know anything better than potash. 4. By cutting off a trolley pole, say, two feet, does it increase or decrease the pressure against the trolley wire? A. It will bear harder against the wire the shorter it is. 5. Has copper ever been hardened to any great extent? A. Not in modern times. It is considered one of the "lost arts" to temper copper. 6. Do you consider the best of lightning arresters a success? A. They are considered indispensable. We do not advertise any goods in this column. 7. If there is such, what do you consider a perfect, at all times waterproof insulation? A. India rubber. 8. Has electricity, as yet, been taken from the earth? A. No more than has been put into the earth. No one has drawn it from the earth for doing work.

NEW BOOKS, ETC.

MARS AND ITS MYSTERY. By Edward S. Morse. Illustrated. Boston: Little, Brown & Co., 1906. 12mo.; pp. 192.

Although Mr. Morse's book hardly rises above the dignity of a compilation, and although it is manifestly based on Mr. Percival Lowell's deservedly well-known and popular work on Mars, it has the value of presenting in a clear and readily understood style the salient arguments for considering Mars an inhabited world—arguments which, to anyone who is at all familiar with Mr. Lowell's splendid studies at his Flagstaff Observatory, must seem irrefutable. The single original chapter of the book, that entitled "My Own Work," will probably be of most interest to the man who is used to handling a telescope. The observations there recorded were made largely without the assistance of any of the Flagstaff astronomers and serve to bring out most tellingly the extreme difficulty of seeing the much-discussed "canals" and "oases" without natural aptitude, long training, and favorable atmospheric conditions. Mr. Morse has drawn upon his knowledge of animal and plant life for many a happy and illuminating comparison. His work is valuable primarily because he has viewed Mars with a naturalist's eye, and endeavored to interpret its enigmatic phenomena accordingly, although his interpretations are decidedly colored by Mr. Lowell's own opinions. For a good, straightforward, and accurate account of what we know about Mars, the book is to be commended.

THE DIFFERENTIAL ARCH DAM "D. A. D." An Elementary Treatise on Masonry Dams for the Use of Parties Interested in Water Power Development, including a General History of the Subject. By George E. Ladshaw. Spartansburg: Carolina Spartan, 1906. 8vo.; pp. 77.

EXPERIMENTAL-UNTERSUCHUNG ÜBER DIE MÖGLICHKEIT EINER DOPPELTELEPHONIE MITTELS UNTERBROCHENER KLÄNGE. By J. W. Giltay. Amsterdam: Johannes Muller, 1906.

CARBON BRUSHES. By J. S. Speer. St. Mary's, Pa.: Speer Carbon Company, 1906. 16mo.; pp. 30.

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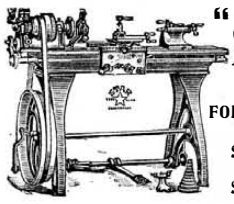

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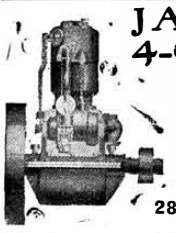

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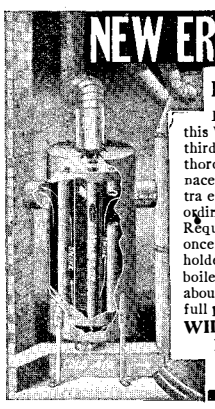

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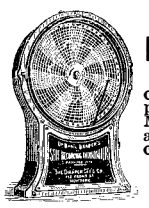

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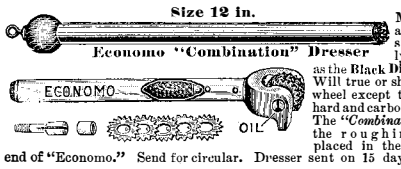

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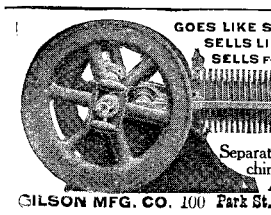

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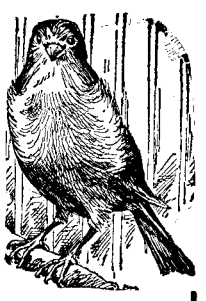

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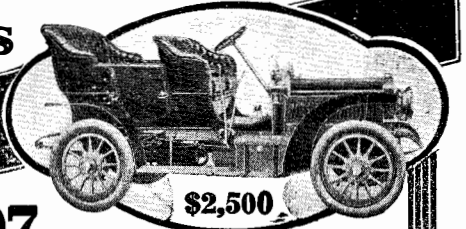

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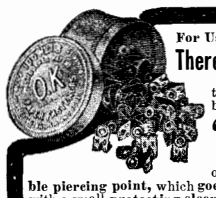

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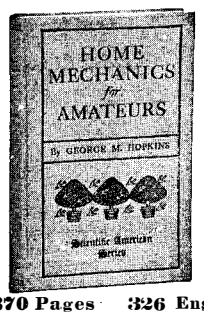

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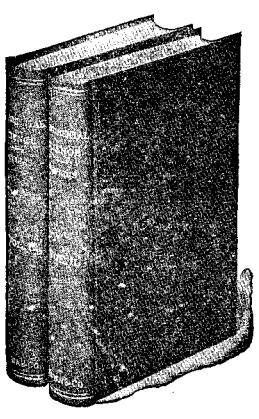

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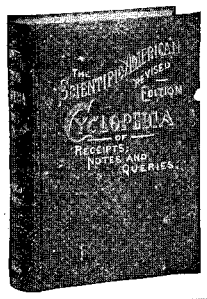

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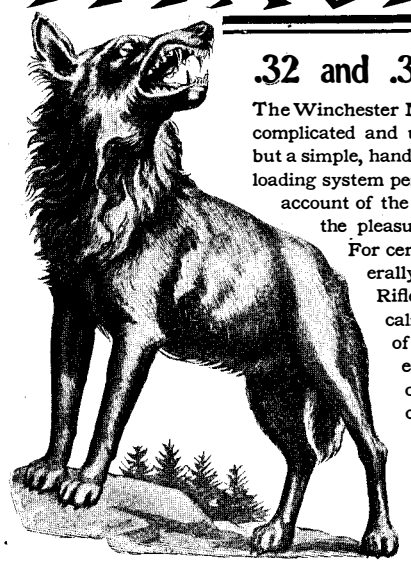

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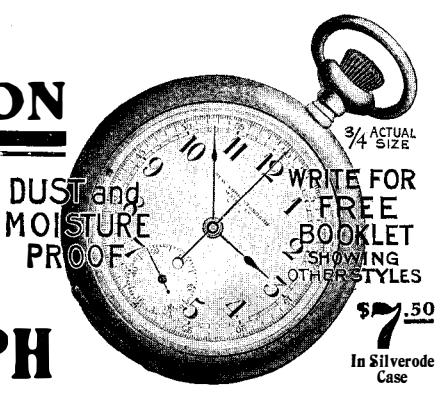

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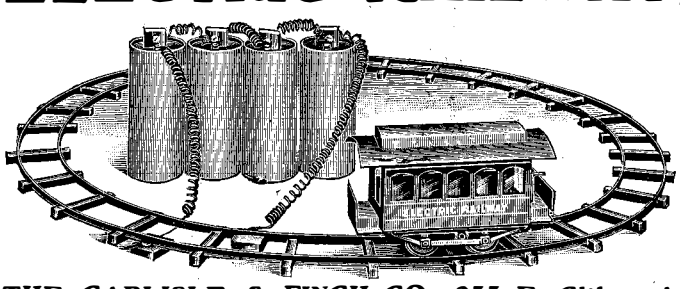

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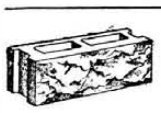

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Remedy for certain named diseases, J. Fahrner	57,163
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Salt for nervine preparations, soluble, Chelf Chemical Co.	57,210
Sawing, trimming, and lumber-handling machinery, McDonough Manufacturing Co.	57,120
Seeding machines, Brennan & Co. Southwestern Agricultural Works	57,137
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Sewing machine needles, National Needle Co.	57,124
Shears and scissors, International Cutlery Co.	57,115
Shears and scissors, Neckelmann Hnos.	57,260
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Soap, E. Conti & F.	57,193
Soap, laundry, Magic Keller Soap Works.	57,198
Soap, laundry, C. W. Young & Co.	57,258
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Suspenders, Bond Manufacturing Co.	57,134
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Syringes, Dr. Pierre Chemical Co.	57,090
Taps, dies, die plates, drills, reamers, augers, and bits, Frasse Co.	57,197
Textiles, certain named, Cumner, Jones & Co.	57,139
Tobacco, smoking, A. A. Kohary	57,117
Tobacco, smoking and chewing, Independent Snuff Co.	57,091
Tobacco, smoking and chewing, Hoffman & Co.	57,114
Turpentine and turpentine substitutes derived from yellow pine, Pine Products Co.	57,181
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Washing powder, N. K. Fairbank Co.	57,224
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Wines, still and sparkling, New Hammondsport Wine Co.	57,180

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"John Noble," for cigars, O. L. Schwencke Litho Co.	13,176
"La Cadiza," for cigars, O. L. Schwencke Litho Co.	13,177
"Metal Fire-Proof Dryers," for drying machines, Dryer Manufacturing Co.	13,189
"Meteor," for evaporated apples, Young, Beach & Maher	13,181
"Old Colony," for pillow cases, Edw. Malley Co.	13,187
"Oriole Plantation Florida Pineapple," for pineapples, F. M. Nellis.	13,180
"Patent Leather Protector," for a preparation for protecting patent leather, A. Sommer	13,183
"Pillsburys Best Cereal," for a breakfast food, Pillsbury-Washburn Flour Mills Co.	13,179
"Prize Leaf," for cigars, O. L. Schwencke Litho Co.	13,178
"Ruberoid Brown Flooring," for brown flooring, Standard Paint Co.	13,190
"Ruberoid Red Flooring," for red flooring, Standard Paint Co.	13,191
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"Solid Comfort Rockers," for rocking chairs, Buckeye Chair Co.	13,188

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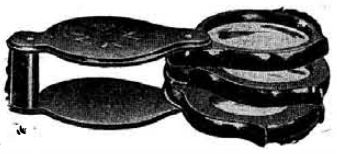

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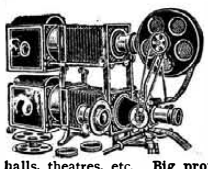

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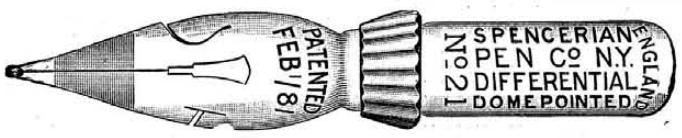

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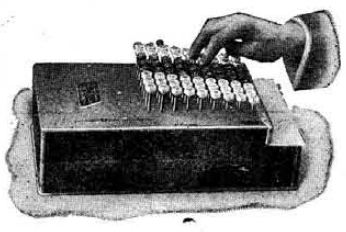

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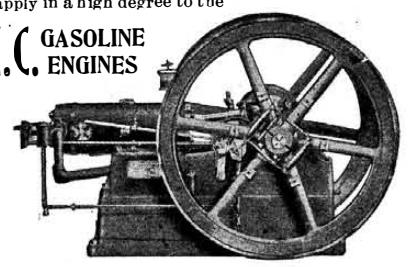

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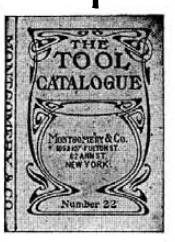

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